ELECTRICAL CONSTRUCTION AND MAINTENANCE

MARCH • 1950

49th Year

Range Wiring

How Detroit plans for volume installation.

Estimating

How to list and tabulate take-off material.

Plus

Other features, departments and Reader Service.

Special Feature

Comfort Control with Unit Equipment

Selection and application of ventilating and cooling equipment for summer comfort.

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Here's the secret of "trigger-start" ballasts: Special windings in the ballast are used for instantaneously pre-heating the lamp cathodes. As a result, the ballast's open circuit voltage becomes sufficient to strike the arc. ***Starters are completely eliminated!***

with GE "trigger-start" ballasts

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with

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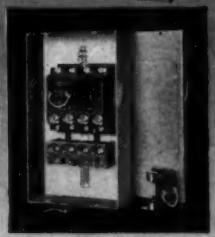

Eight branch circuits, three-wire range connections, and an extra hot water heater tap are provided in this new Murray Main Service & Range Switch. Two styles for 60 amp. 125-250 volt 3 pole service — 100 amp. service lugs. Plenty of hand room for wiring all 8 circuits and range! For surface or flush mounting. Cat. No. 74-8 (Series); Cat. No. 77-8 (Parallel).

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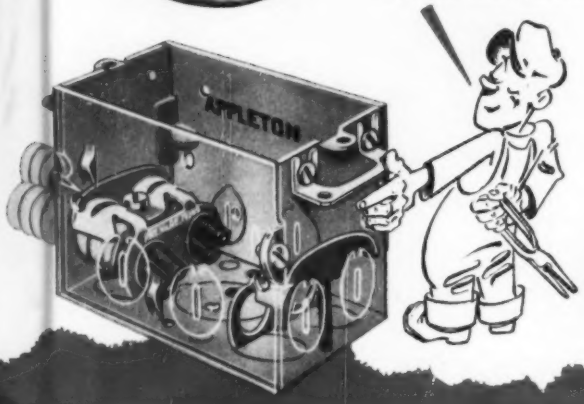

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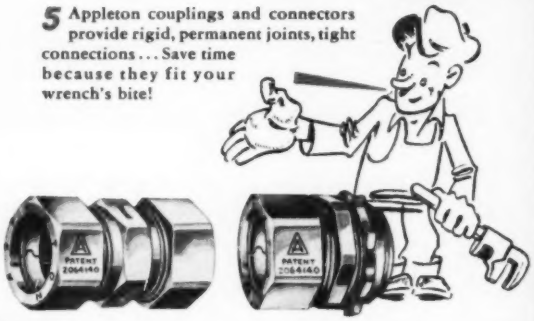

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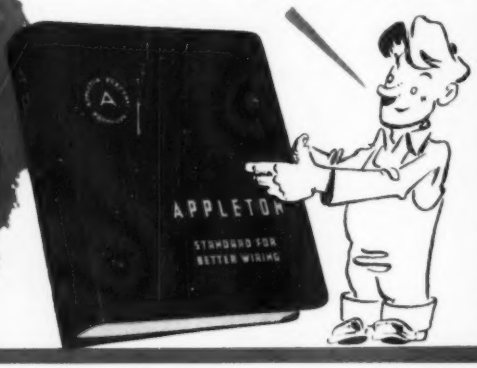

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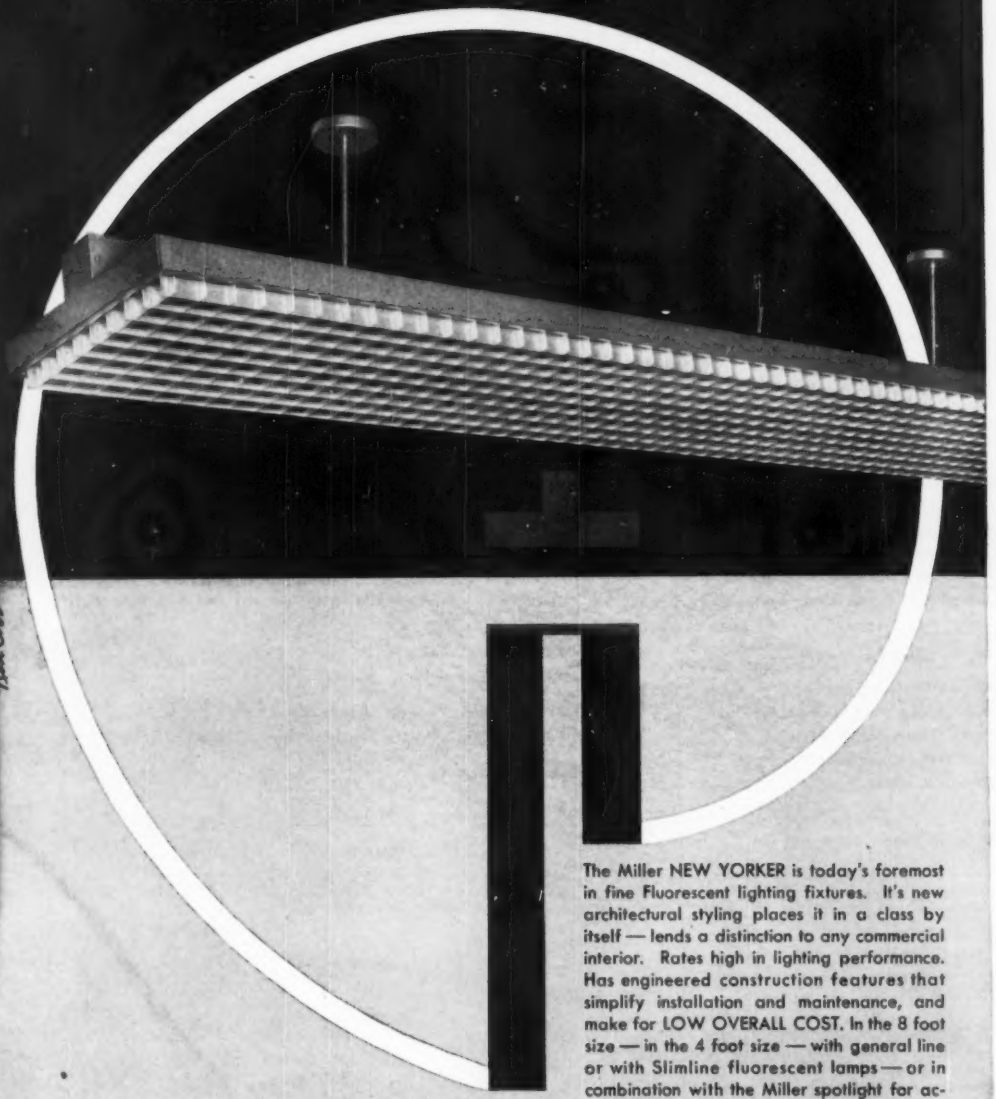

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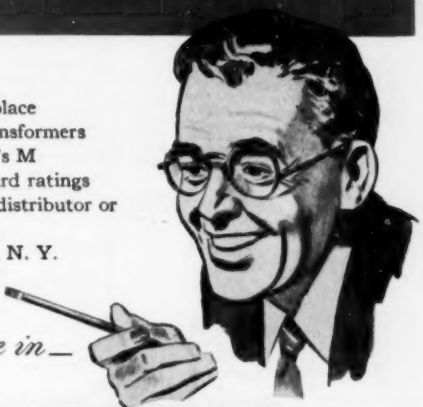

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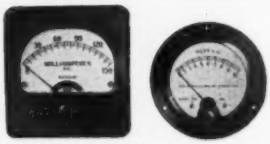

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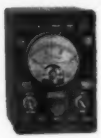

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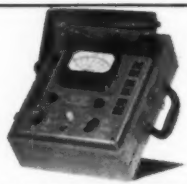

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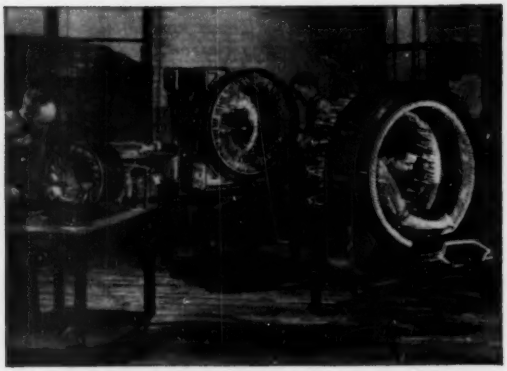

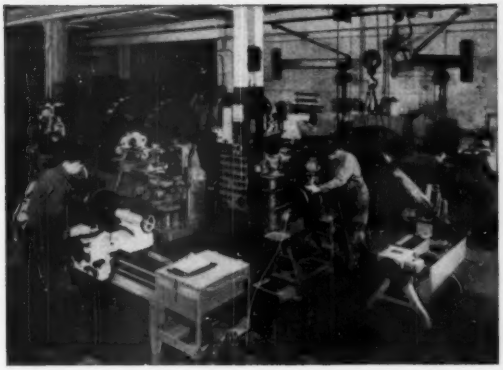

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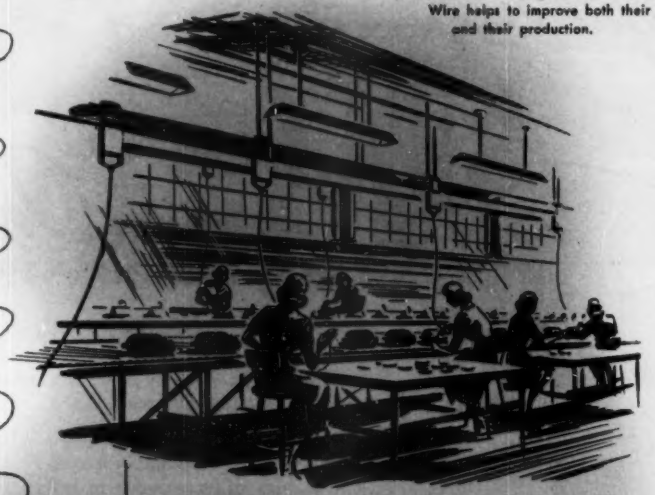

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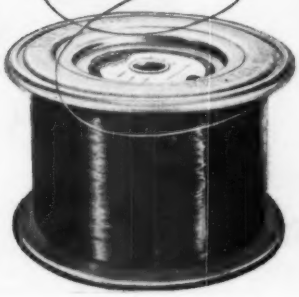

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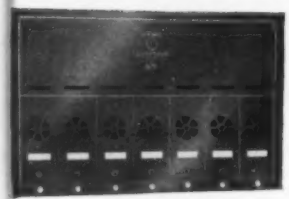

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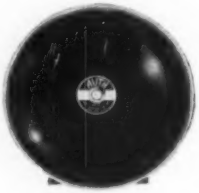

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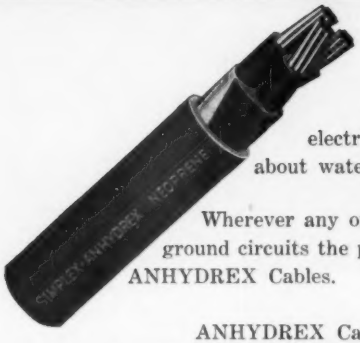

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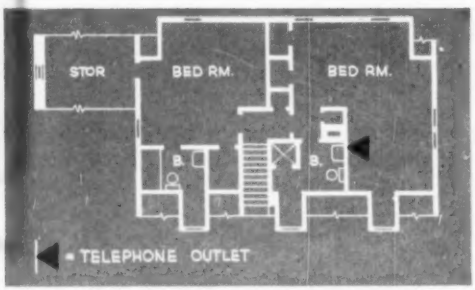
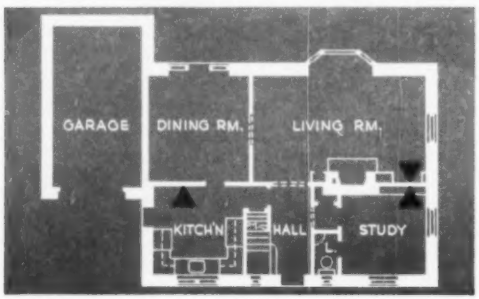
EDWIN A. NEALE, *Architect*

ALL THINGS CONSIDERED—INCLUDING TELEPHONE RACEWAYS





It's especially true in small homes—thoughtful details are often the strongest selling points. Built-in raceways for concealed telephone wiring are one feature sure to impress today's home buyer . . . and they mean extra profits for you.

Installing telephone raceways is easy. A few lengths of pipe or flexible tubing, placed inside the walls during construction, will carry the wires to the outlets.

Remember—NO ELECTRICAL CONTRACT IS REALLY COMPLETE UNLESS IT CONTAINS RACEWAYS FOR TELEPHONE WIRES.

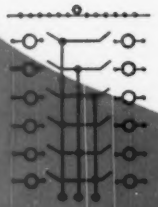
BELL TELEPHONE SYSTEM

LNT1P Panelboard with "sequence bussing"

INSTALLATION AND INSPECTION TIME HAVE BEEN REDUCED to a minimum in the re-designed FA LNT1P PANELBOARD *with "sequence bussing."*

This method of bussing cuts installation time . . . speeds up inspection time due to the simplified sequence arrangement of circuits . . . and provides better balance of load because adjacent circuits are of opposite polarity.

Also featured in the improved LNT1P is a new 4-circuit standardized section with heavy-duty, 30-amp. single pole tumbler switches and plug fuses.



provides better *balance of load*

All parts, including switches, are applied from the rear to make the LNT1P a safety-type panelboard under all operating conditions . . . no removable covers to become loose or fall off due to tampering.

Capacities: 30 amp., 250 volt switches, 4 to 40 branches for 3 or 4 wire solid neutral mains . . . 200 amp. maximum capacity . . . with main lugs or safety type main fuse disconnect.

For more information about this lighting panelboard and other FA Panelboards, contact your nearest FA Representative (he's listed in Sweet's) . . . or write for Bulletin 301.

FA TRADE MARK

Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

Light for tomorrow *Today!*

WITH PITTSBURGH PERMAFLECTOR
LIGHTING EQUIPMENT

Pittsburgh Permaflector Fluorescent and Incandescent Lighting Equipment is "years ahead" in sound engineering and construction, in design—with functional beauty adaptable to any type of installation, and in economy, ease of installation and ease of maintenance. These points of superiority benefit all who use lighting. Ask for complete details on how and why Pittsburgh Permaflector Lighting Equipment gives you the "light for tomorrow"—today!

Independent Pneumatic Tool Co.
Chicago, Ill.

A. Epstein & Sons—Architect
Marsh Electric Co.—Elec. Con.

For a Picture Story about
PLANNED LIGHTING

Write and tell us whether you are interested in store, office, bank, school or other type of lighting and a Bulletin covering the subject will be sent you promptly.

PITTSBURGH REFLECTOR COMPANY

404 OLIVER BUILDING • PITTSBURGH 22, PENNSYLVANIA

MANUFACTURERS OF FLUORESCENT & INCANDESCENT LIGHTING EQUIPMENT

Permaflector Lighting Engineers in All Principal Cities

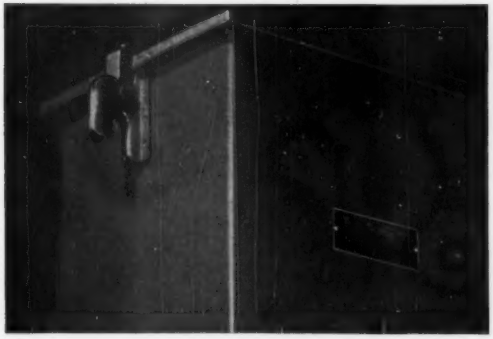
PITTSBURGH PERMAFLECTOR LIGHTING EQUIPMENT IS DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

Save Work!

ALLIS-CHALMERS
DRY-TYPE
TRANSFORMERS

1 They're Smaller—Lighter—Easier to Handle!

Class "B" Fiberglas insulated, they're up to ⅓ smaller, ⅓ lighter than conventional insulated types. Means more flexibility of mounting, saved time and effort.



2 Convenient Lifting Hooks for Easy Hoisting!

They're safe too, because they're fabricated steel, not cast. Hooks project well out for easy handling. Rounded edges prevent abrasion of hoist cable.

3 Time-Saving Solderless Clamp Connectors!

This is a standard feature on many popular sizes. (On small sizes, connections are made easily with convenient front and bottom drop out plates.)

YOU NOT ONLY save time and effort when you put these transformers right at the load; you also eliminate long secondary runs, reduce losses, improve voltage regulation. For details write for NEW bulletin 61B6382A, or call your A-C office. A-2963

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

TOOL UP WITH *Toledo Advantages* FOR THREADING 1" TO 2" PIPE!

Save Job-Time... Reduce Costs

Take the short and easier way to get perfect 1" to 2" threads—use a genuine TOLEDO Pipe Tool!

Many thousands of better mechanics today have used a *Toledo 1A Ratchet Threader* for years—a tool that's famous for efficiency, economy and dependability.

Others prefer the plus features of a Toledo 1BR Ratchet Threader . . . similar to the 1A, but also has pipe holder with broad faced chuck jaws easily set by wing-head thumb screws. Assures accurate centering and firm grip.

If you want a self-contained tool—use the finest of 'em all—Toledo SIMPACT! Threads clean and fast . . . one set of high speed steel dies does work of four . . . no loose parts . . . sizes changed instantly.

Whether it's hand tools or power equipment—get time-proven TOLEDO advantages for every pipe fitting requirement! The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

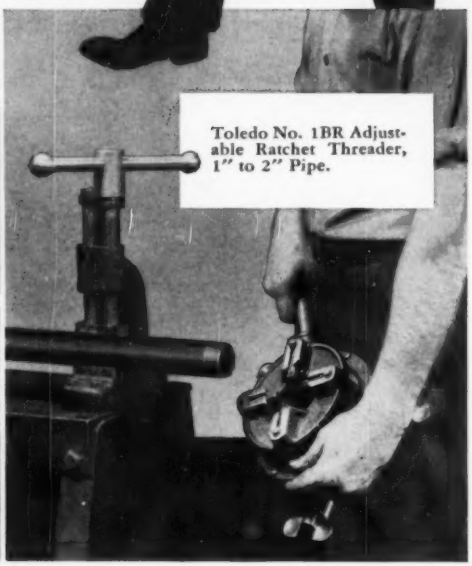
RELY ON THE LEADER

TOLEDO

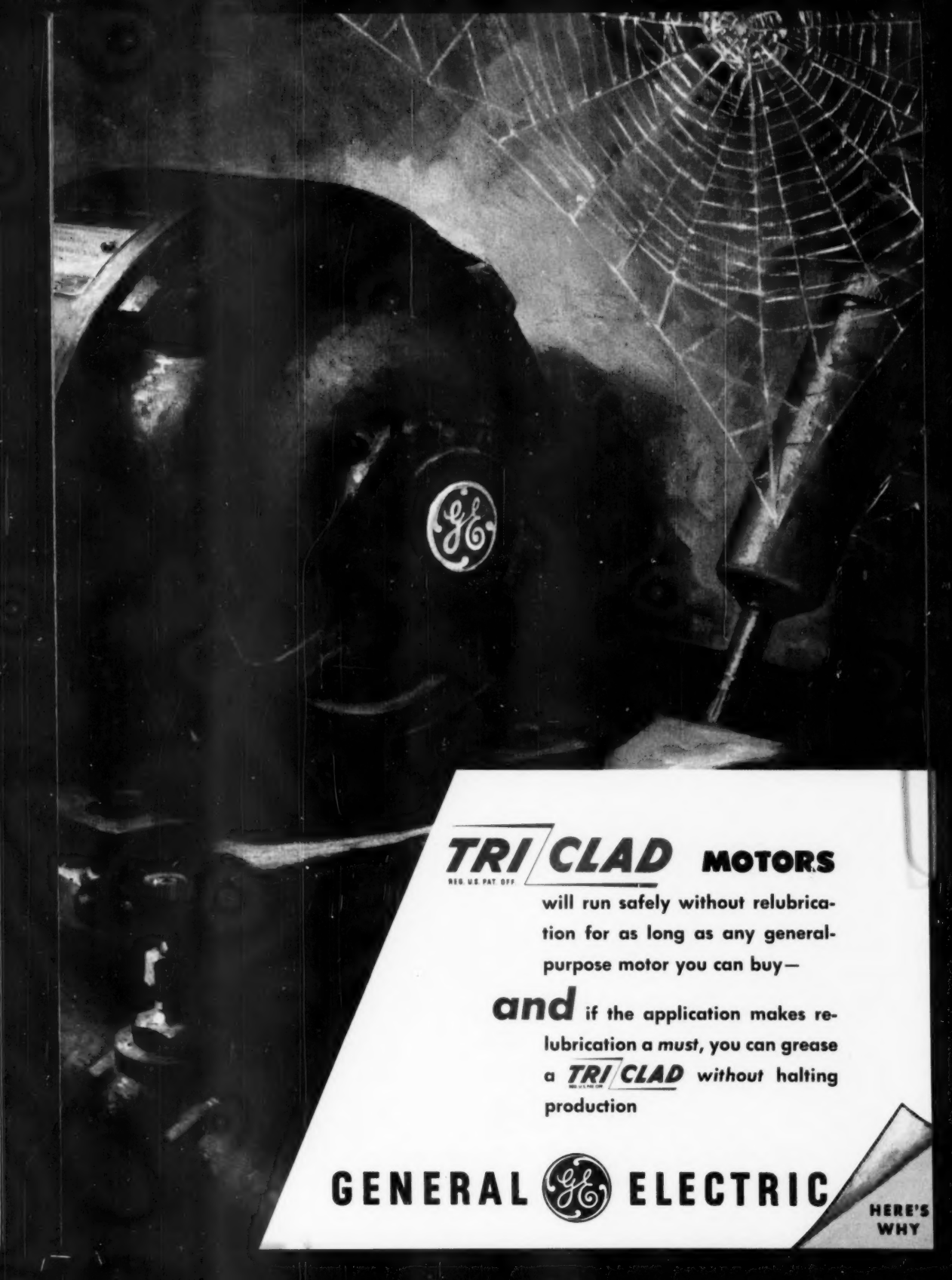
FOR PRECISION PIPE TOOLS

Toledo No. 1A Adjustable Ratchet Threader, 1" to 2" Pipe.

Toledo SIMPACT—self-contained, adjustable threader, 1" to 2" Pipe.



Toledo No. 1BR Adjustable Ratchet Threader, 1" to 2" Pipe.



TRI/CLAD MOTORS

REG. U.S. PAT. OFF.

will run safely without relubrication for as long as any general-purpose motor you can buy—

and if the application makes relubrication a *must*, you can grease a **TRI/CLAD** *without* halting production

GENERAL ELECTRIC

HERE'S WHY

TRI CLAD MOTORS will run safely without relubrication for as long as any general-purpose motor you can buy—

Tri-Clad extra lubrication "protection" can save you money because:

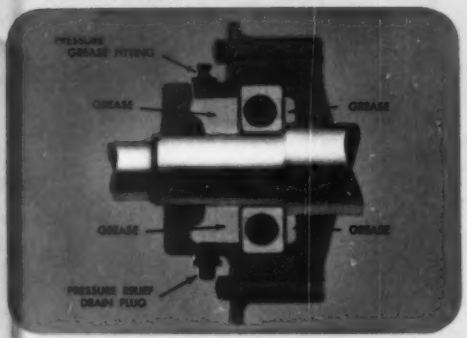
1. Tri-Clad's oversize grease reservoir and the heaviest standard-service bearings mean you do not have to bother with greasing between motor check-ups.

2. When relubrication is needed on those tough applications, you can grease a Tri-Clad without interrupting production-line operations.

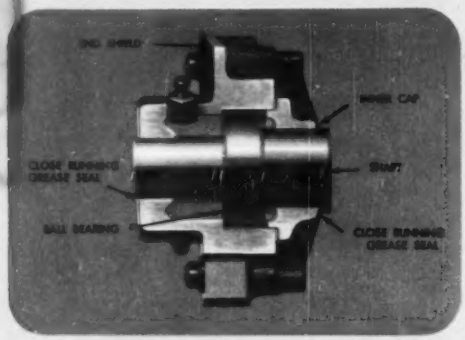
Tri-Clads are grease-gun easy to lubricate *on the job*. Moreover, a Tri-Clad motor will run safely where an ordinary motor would fail. Chances are you'll be spared the cost of a "special" motor.

YOU BE THE JUDGE! The best way to prove to yourself that Tri-Clad gives you the most for your motor dollar is to contact your local G-E office. Tri-Clad stocks are complete. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

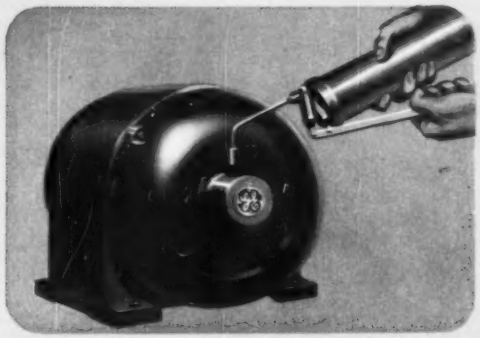
1 **EXTRA BEARING PROTECTION** — Tri-Clad gives you extra bearing protection because heaviest standard-service bearings are carefully selected to withstand severe loads for long periods.



2 **EXTRA GREASE** — Four times the ordinary amount of grease is packed into the large Tri-Clad grease reservoir. Since bearing life depends on grease, this means that Tri-Clad motors will run safely for years — for as long as any general-purpose motor you can buy.



3 **SEALED-IN BEARINGS** — Bearings and grease are completely sealed in a cast housing with long running seals for extra protection from dirt, dust, and lubricant leakage.



4 **PRESSURE-RELIEF GREASING** — An efficient system of pressure-relief lubrication (with standard fittings) enables a Tri-Clad motor to be quickly and easily greased on the job when and if it's needed.

GENERAL ELECTRIC

732-3

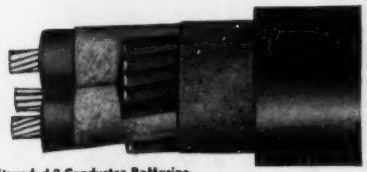
APPROVED for airport lighting & control circuits

RoMarine - RoPrene

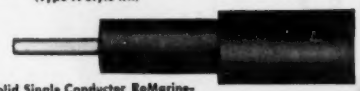
TYPE A STYLE RR

RoZone* - RoPrene

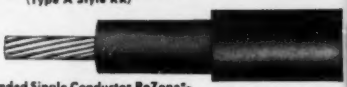
TYPE B STYLE ROR



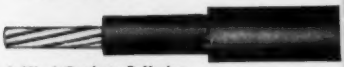
Stranded 3 Conductor RoMarine-RoPrene cable. 3000 Volt Rating. (Type A Style RR)



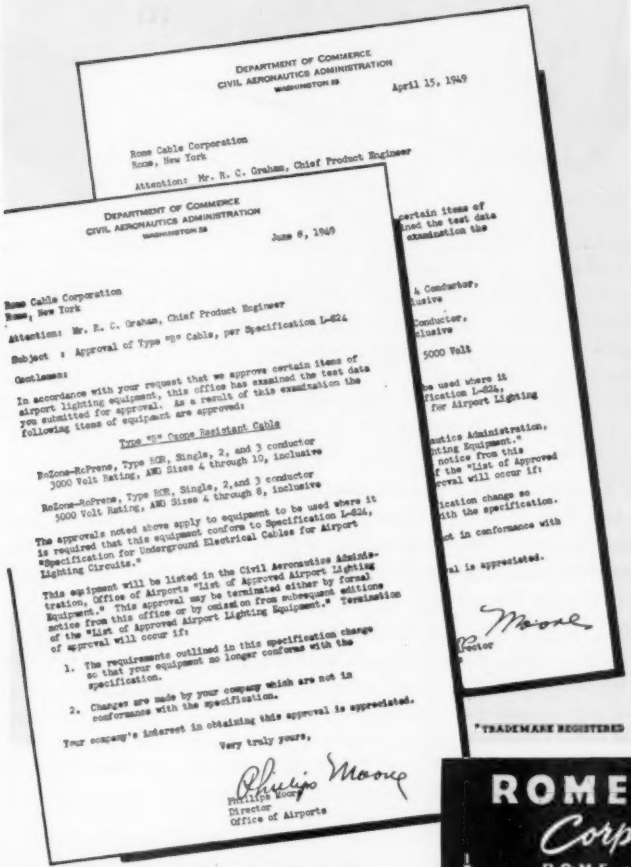
Solid Single Conductor RoMarine-RoPrene cable. 5000 Volt Rating. (Type A Style RR)



Stranded Single Conductor RoZone*-RoPrene cable. 3000 Volt Rating. (Type B Style ROR)



Stranded Single Conductor RoMarine-RoPrene cable. 600 Volt Rating. (Type A Style RR)



DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION
WASHINGTON 25

April 15, 1949

Rome Cable Corporation
Rome, New York

Attention: Mr. R. C. Graham, Chief Product Engineer

DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION
WASHINGTON 25

June 8, 1949

Rome Cable Corporation
Rome, New York

Attention: Mr. R. C. Graham, Chief Product Engineer

Subject : Approval of Type ngs Cable, per Specification L-824

Gentlemen:

In accordance with your request that we approve certain items of airport lighting equipment, this office has examined the test data you submitted for approval. As a result of this examination the following items of equipment are approved:

Type ngs Ozone Resistant Cable

RoZone-RoPrene, Type RGR, Single, 2, and 3 conductor 3000 Volt Rating, AWG Sizes 4 through 10, inclusive

RoZone-RoPrene, Type RGR, Single, 2, and 3 conductor 5000 Volt Rating, AWG Sizes 4 through 8, inclusive

The approvals noted above apply to equipment to be used where it is required that this equipment confore to Specification L-824, "Specification for Underground Electrical Cables for Airport Lighting Circuits."

This equipment will be listed in the Civil Aeronautics Administration, Office of Airports "List of Approved Airport Lighting Equipment." This approval may be terminated either by formal notice from this office or by omission from subsequent editions of the "List of Approved Airport Lighting Equipment." Termination of approval will occur if:

1. The requirements outlined in this specification change so that your equipment no longer conforms with the specification.
2. Changes are made by your company which are not in conformance with the specification.

Your company's interest in obtaining this approval is appreciated.

Very truly yours,

Phillips Moore
Director
Office of Airports

*TRADEMARK REGISTERED

When you bid on airport lighting and control circuit jobs, make sure your quotation specifies RoMarine-RoPrene or RoZone*-RoPrene cables. Why? Because these Rome cables are approved by the Civil Aeronautics Administration under Specification L-824. This means they have passed rigorous tests with flying colors and are acceptable for all CAA sponsored airport contracts. Further, they are the best you can offer for any job.

Here is something else to bear in mind. Even if you bid on an airport job that is not CAA sponsored now, it may be later. Therefore, be smart and specify these Rome CAA approved cables on every airport wiring job.

It Costs Less to Buy the Best . . .

Buy Rome Cable

ROME CABLE
Corporation
ROME · NEW YORK
From Bar to Finished Wire

all new all the way thru

Buy One

MOTOR STARTERS with the 'Strongbox' Magnet Coil

All the best features in popular sizes for motors to 50 hp. See for yourself. Get a new General Electric Motor Starter. Get out your screwdriver. And get the facts. Make your own comparison on these big ALL-NEW features:

STRONGBOX MAGNET COIL – Coil is locked in a tough block of plastic.

NEW ARC HOOD – Molded, burn-resistant arc hood snuffs arc immediately.

NEW CONTACTS – Large silver contacts with plenty of contact pressure give long life. Convertible from normally open to normally closed in size one and smaller – without additional parts.

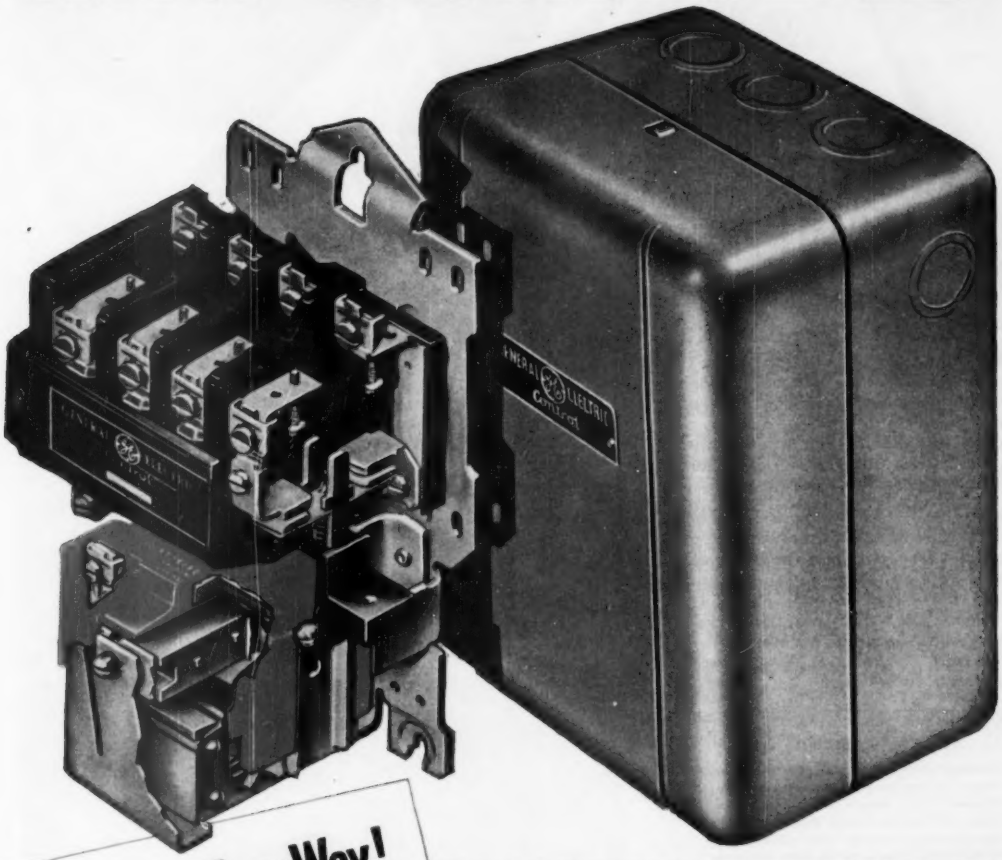
NEW MAGNET – Quick direct action, large striking surface.

EASY TO INSTALL – EASY TO MAINTAIN – See how easy it is to get at the ALL-NEW General Electric starter. Note, too, that it's built to take the punishment of day-in, day-out use with a minimum of maintenance. Check the wiring space inside the case. Check the terminal clamps that make installation fast. Check the ease with which controls can be inspected.

DESIGNED FOR FAST ACTION – BUILT FOR LONG LIFE – From the tough STRONGBOX magnet coil to the high strength arc hood, all parts of the new General Electric Motor Starter are built to last. In the revolutionary G-E design, the plastic coil enclosure also serves to guide the armature. For fast, positive action the tough plastic block is impregnated with a permanent lubricant – molybdenum sulphide. Channel-reinforced magnet guides slide smoothly for quick action at all times. Bimetallic thermal relays give swift protection.

GENERAL ELECTRIC

and COMPARE



Order this Easy Way!

Look inside. Make the screwdriver comparison test. Inspect the many new features, and we're sure you'll be enthusiastic. Just fill in the coupon at the right and we'll send you the starter immediately. Or, if you prefer, we'll be glad to send you the new, free, tell-all booklet "Look Inside and Compare" that gives more detailed information.

General Electric Company, Apparatus Department
Section K676-281, Schenectady 5, N. Y.

Send me one of the NEW CR7006 starters (size 1, 3 pole, enclosed). List Price $22.00.

_____ Check Enclosed. (Add any state or local sales or use taxes)

_____ Purchase order attached; bill to our account with: _____

_____

_____

(Name and address G-E sales office or G-E distributor.)

Motor Horsepower Rating (check one)

☐ 3 ☐ 5 Horsepower at 220 Volts } 60 Cycles, 3 Phase
☐ 3 ☐ 5 ☐ 7½ Horsepower at 440 Volts }

Approx. Motor Speed ☐ 1800 RPM ☐ 3600 RPM ☐ 1200 RPM

Name_____

Address_____

City_____ **Zone**_____ **State**_____

Because
IT MUST
BE RIGHT

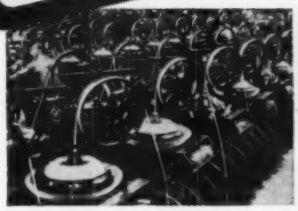
You
can count on
TRIANGLE'S
GLAZON
TRADE MARK
...Newest Development in BUILDING WIRE

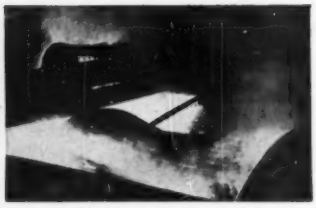
Prove to your own satisfaction, as others have, that "Glazon" is the building wire for your jobs. Prove to yourself that it pulls easier . . . twists around bends more flexibly . . . handles better than any other building wire you've ever used!

Prove, too, that "Glazon" means longer life . . . better protection . . . greater resistance to exposure and deterioration. And prove to yourself what others have learned: that "Glazon's" easier handling and longer life—at no extra premium—all add up to today's greatest building wire value!

What "Glazon" Is:

"Glazon" incorporates a tougher, smoother, longer lasting braid based on continuous filament glass yarn—which cannot rot, burn, absorb moisture or deteriorate with age. Special saturants bond permanently to individual fibers, setting new standards of resistance to moisture, fire and rot. Result: smaller diameter, greater flexibility, smoother surface—in short, vastly improved fishability...combined with still longer life.





The Right Combination—"Glazon" protective coverings combine carefully controlled braiding, specially developed saturants—and manufacturing technique exclusive with Triangle. "Glazon" means building wire at its best!

The Trade Mark Of Top Value

TRIANGLE CONDUIT & CABLE CO., INC.

1908 JERSEY AVENUE • NEW BRUNSWICK, NEW JERSEY

IT MUST BE RIGHT!

Catalog No. 500 Gives Full Details Of the Complete Triangle Line

"Glazon" & "Triloseal" Building Wire • "Tricon" Control Wire • "Adaptal" General Purpose Wire • "Triex" Non-Metallic Sheathed Cable • "Trioprene" Trench Cable • Service Entrance, Parkway, Power & Varnished Cambric Cables • "Tristeel" Flexible, Thin Wall & Rigid Steel Conduit

IDEAL Wire-Nuts®

THE SOLDERLESS, TAPELESS, WIRE CONNECTORS
Patented — No. 1,933,555

Now Fully Approved

FOR ALL TYPES OF BRANCH CIRCUIT WIRING

Contractors' Sizes 74B and 76B Now Listed by UNDERWRITERS' as PRESSURE CABLE CONNECTORS (General Use)

This new approval means that IDEAL "Wire-Nuts" (Sizes 74B and 76B) can now be used for all types of branch circuit wiring . . . conduit . . . armored cable . . . non-metallic sheathed cable and open wiring. Improved materials and manufacturing methods make possible this broader approval.

IDEAL built an entire new plant devoted exclusively to the production of "Wire-Nuts". It developed and put into use even more rigid inspection and testing methods—still higher precision control standards.

Today, to a greater degree than ever before, IDEAL "Wire-Nuts" are the safest, surest way to make fully approved wire joints. Far easier, too—just screw them on, like a nut on a bolt—no solder, tape or cumbersome tools! *And, "Wire-Nuts" cut wiring costs!* But, make sure you get *genuine* IDEAL "Wire-Nuts" — the screw-on connector listed by Underwriters' Laboratories, Inc. for circuit wiring. Order from your IDEAL Distributor today!

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Ill.

Please send free sample IDEAL "WIRE-NUTS"

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

DISTRIBUTED THROUGH AMERICA'S LEADING WHOLESALERS

IDEAL INDUSTRIES, Inc.
Sycamore, Illinois

BOTH CARRY 390 AMPS.

BUT ROCKBESTOS A.V.C.® IS 43% SMALLER

With higher-rated A.V.C. and a 390 ampere load INSTALLED COSTS ARE LOWER*—

- you use a 400 MCM cable *not* 700 MCM
- you use 3" conduit *not* 3½"
- you use *smaller* fittings and lugs
- you have *lower labor costs* because smaller, lighter cable and conduit are quicker and easier to handle.

Size for size A. V. C. has a HIGHER AMPERE RATING

Hi

. . . YOUR BEST BUY

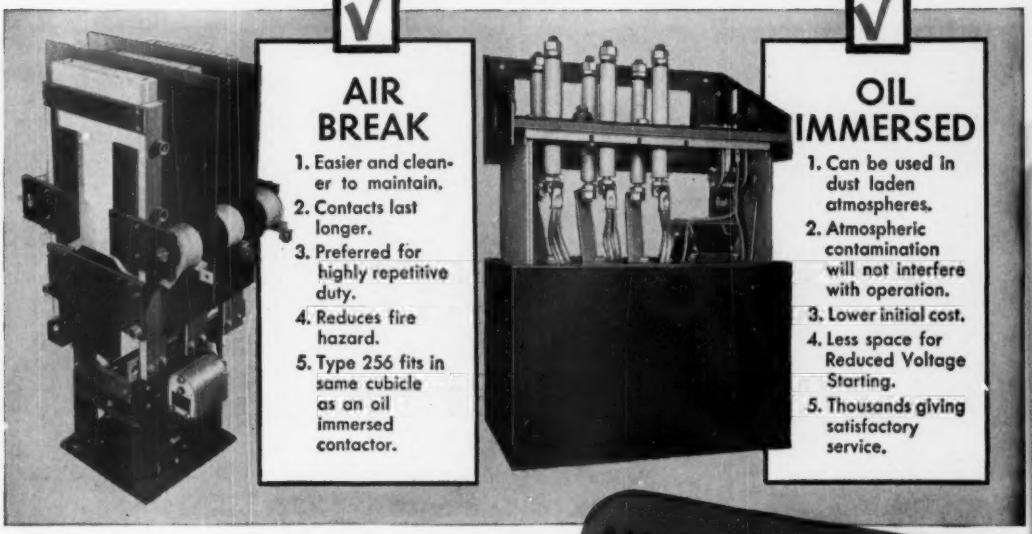
Permanently-insulated Rockbestos A.V.C. can save you money. Write for the booklet "Cut Current Carrying Costs."

*Comparison with Type RH based on Chapter X—National Electrical Code, 40°C-104°F Ambient

ROCKBESTOS A.V.C.

ROCKBESTOS PRODUCTS CORPORATION
New Haven 4, Connecticut
NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH
ST. LOUIS • LOS ANGELES • OAKLAND, CAL.

Which Contactor is Best for You?



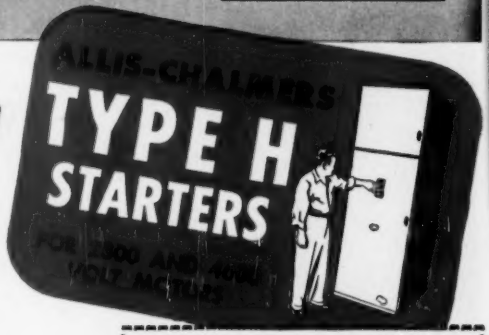
AIR BREAK

1. Easier and cleaner to maintain.
2. Contacts last longer.
3. Preferred for highly repetitive duty.
4. Reduces fire hazard.
5. Type 256 fits in same cubicle as an oil immersed contactor.

OIL IMMERSED

1. Can be used in dust laden atmospheres.
2. Atmospheric contamination will not interfere with operation.
3. Lower initial cost.
4. Less space for Reduced Voltage Starting.
5. Thousands giving satisfactory service.

You can get either in



OIL OR AIR — whichever contactor is best suited to your application can be built into Allis-Chalmers Type *H* Starters. Both are designed for ready access . . . built to give long life with low maintenance. And regardless of the contactor you select, all Allis-Chalmers Type *H* Starters give split-cycle short circuit protection through current limiting fuses.

You get *complete* protection in one attractive, easy to install steel cabinet. Segregated high voltage compartment, enclosed bus bars and safety door interlock protect personnel. Overload and time delay undervoltage devices are coordinated with the contactor to protect motor and equipment.

Choose the starter to fit your needs. For full or reduced-voltage starting, reversing or dynamic braking of squirrel-cage, wound rotor or synchronous motors . . . Allis-Chalmers Type *H* Starters will be your right answer. Call your nearby A-C representative or send coupon today.

ALLIS-CHALMERS

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

Please send me more information on Allis-Chalmers Type *H* Starters. ☐ Include bulletin 14B7303 on Type 256 Air Break Contactor.

Name _____

Title _____

Company _____

Address _____

City _____ State _____

A-2926

It's easier to work

the Threadless way

With threadless *ELECTRUNITE E.M.T., you merely cut the tubing to desired length, slip on the simple compression coupling and tighten with wrench and pliers . . . no need for thread-cutting or turning long lengths of conduit into the fitting.*

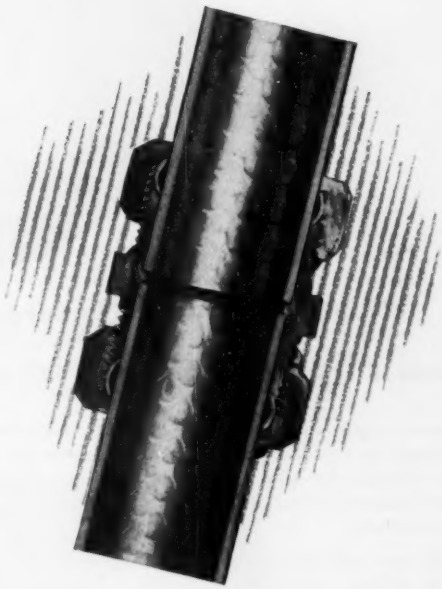
with ELECTRUNITE E.M.T.

Any way you look at it, wiring jobs go in easier when you use ELECTRUNITE E.M.T.— the *modern* lightweight rigid steel wiring raceway.

With ELECTRUNITE E.M.T., tight-gripping compression fittings eliminate tedious thread-cutting . . . bends are made quickly and easily with predetermined accuracy . . . wire pulling, by actual test, is as much as 30% easier than with ordinary types of conduit.

Yes, by any yardstick, ELECTRUNITE E.M.T. is easier to handle and easier to install. Yet, it provides the safe, dependable wiring protection that you get *only* in rigid steel raceways. For complete information about all of the job-proved advantages of ELECTRUNITE E.M.T., see your nearest ELECTRUNITE Distributor or write *today* to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.



Cross-section cutaway showing two lengths of ELECTRUNITE E.M.T. joined by a water-tight compression fitting. Note the knurled inside surface that cuts down friction drag when wires are pulled through an ELECTRUNITE raceway.

REPUBLIC STEEL

Republic
ELECTRUNITE E.M.T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

General's *New* Front-Operated Toggle Plug Fuse Safety Switch

now available . . . with or without dead front plate

The Switch is to General because General makes a better switch

Years of engineering research and careful testing have resulted in outstanding product improvements throughout our entire line. For example, the new Toggle Switch line contains many distinctive features which will be apparent to you immediately upon examination.

Other new and improved products now in production are the triple pullout—new raintight equipment—improved main and range combinations—and 100 Amp. fusible service equipment . . . all items finished in machine gray baked enamel and sold everywhere exclusively through wholesalers.

Write for our latest catalog, No. 4809—and supplement No. 4911.

FEATURES

- *Snap-action; toggle actuated*
- *Dependable, full-floating contacts*
- *All parts visible and easily accessible*
- *Laminated arc shields—easily removable*
- *Solderless pressure wire connectors on line side*
- *Can be locked or sealed with padlock in either ON or OFF position*
- *Ample wiring room and abundant knockouts*

Available for immediate delivery
(Described in detail in current Catalog 4809, page 12)

Catalog Number	Poles or Wires	Blades or Contacts	Plug Fuses	Neutral
*632NP	2	1	1	Solid
*632P	2	2	2	None
*633NP	3	2	2	Solid

**All available with dead front shields—add suffix X (viz 632NPX)*

General Switch Corp.

49 Roebling Street Brooklyn 11, N. Y.

One of the largest Manufacturers of:

SERVICE EQUIPMENT . . .
Pullout, Front Operated Toggle and Side Operated types. Indoor—surface or flush, and Outdoor.

SAFETY SWITCHES . . .
30 through 1200 Amp., 250 V and 600 V Type A, C and D. Indoor and outdoor. HP rated.

ELECTRICAL DISTRIBUTION EQUIPMENT

SALES OFFICES IN EVERY MAJOR CITY

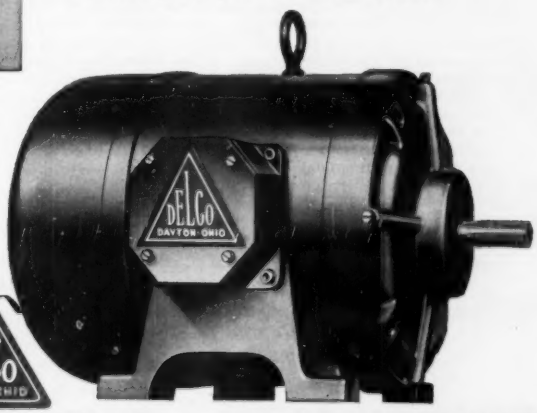
On more and more spec sheets . . .

Delco preferred!

- Positioned Bearings
- Delcote Coil Insulation
- Corrosive-Resistant Cast Iron Frame
- Positive Lubrication
- Dynamically Balanced Rotor and Shaft Assembly
- Water-Tight Conduit Box

Two words that mean top motor performance

You see the words "DELCO PREFERRED" on more and more spec sheets. That's because Delco motors are built the way production men want motors built. They are rugged, dependable, and made of the finest materials. A few of the performance extras that Delco motors give you are listed here:



Get complete data on Delco motors. Call or write Delco Products, Dayton, Ohio . . . or get in touch with the nearest sales office listed below.

DELCO DAYTON OHIO

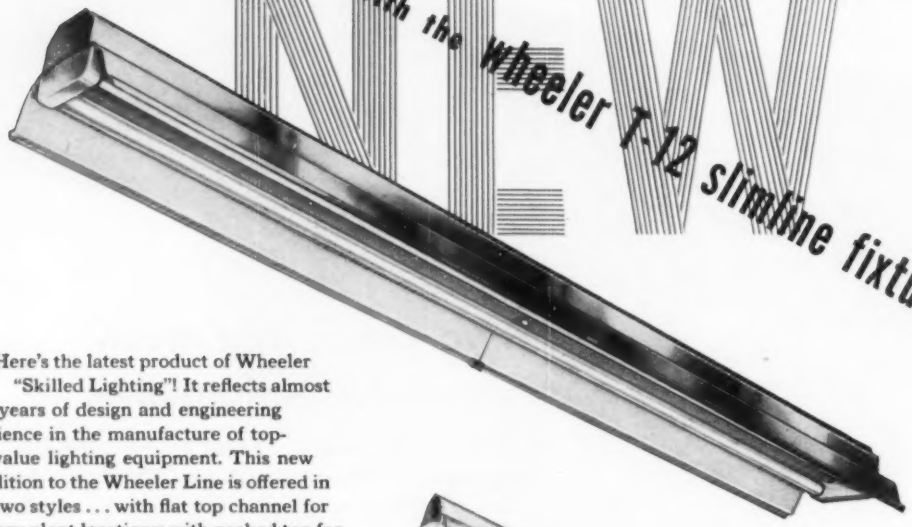
DELCO MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

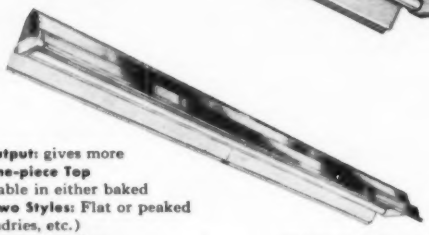
SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD, CONN.

modernize your plant lighting with the Wheeler T-12 slimline fixture

NEW



Here's the latest product of Wheeler "Skilled Lighting"! It reflects almost 70 years of design and engineering experience in the manufacture of top-value lighting equipment. This new addition to the Wheeler Line is offered in two styles . . . with flat top channel for ordinary plant locations; with peaked top for locations where excessive moisture and dust-laden air conditions exist.



PEAKED TOP MODEL

6 Better-Value Features **1. High Output:** gives more light per foot of lamp length. **2. One-piece Top Channels:** made of heavy gage steel. Available in either baked enamel or vitreous porcelain enamel finish. **3. Two Styles:** Flat or peaked top channels (the latter for textile mills, foundries, etc.) **4. Reflectors in Sections:** for greater ease in handling, each unit furnished with two open-end-type porcelain enamel reflectors. **5. Individual or Continuous Mounting. 6. Latest G.E. Twin-Turret Type Lampholders** (depressable): for single pin contact, making lamp insertion and removal simple.

The new T-12 Slimline Unit is designed for use with two 75 watt, 96" T-12 Slimline single pin lamps (instant starting) operating at 425 MA. Send for complete details of this new "Skilled Lighting" fixture built to stay new-looking for years. *Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.* Also New York, N. Y. Representatives in principal cities.

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

Wheeler **REFLECTORS**

SKILLED LIGHTING

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

1 TO 42 CIRCUITS

SQUARE D MULTI-BREAKERS

for Lighting and Appliance Loads

Coilless

THERMAL—MAGNETIC. Thermal element deflects in proportion to temperature of wire insulation resulting from both surrounding air and losses within the conductor. Magnetic element responds instantly to heavy overloads or shorts. Both are needed for complete protection.

REPEAT PROTECTION. Nothing burns out . . . nothing to replace. No live parts are exposed. Anyone can quickly restore service.

NON-TAMPERABLE. Factory test-tripped and sealed. Eliminates well-intentioned but dangerous "doctoring" to accommodate higher loads.

SWITCHING. Circuits can be manually switched "ON" or "OFF" in addition to the automatic "TRIP" and manual "RESET" protective functions.

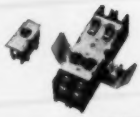
CONVENIENCE. Multi-breakers are attractive and occupy very little space. Mount them in any location. Provide for future expansion.

Write for Bulletin SA590. Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

flexible

Basic multi-breaker mechanism lends itself to either single or multi-pole construction.

Types MO 1, MO 2 and MO 4 for branch circuits and small homes where high volume and low cost are controlling factors. Similar parts are assembled in 1, 2 and 4 pole blocks.



Type MO 8 for average homes. 4 pole basic block meets minimum requirements. "Ad-On" single pole breakers increase total to 5, 6, 7 and 8 circuits as required.

Types MO 12 and MO 20 for larger homes. "Plug-In" 2 or 4 pole breakers cover the range of 4 to 20 circuits.

MO Panelettes and NMO Panelboards extend range to 42 circuits for stores, institutions, buildings and factories.

SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

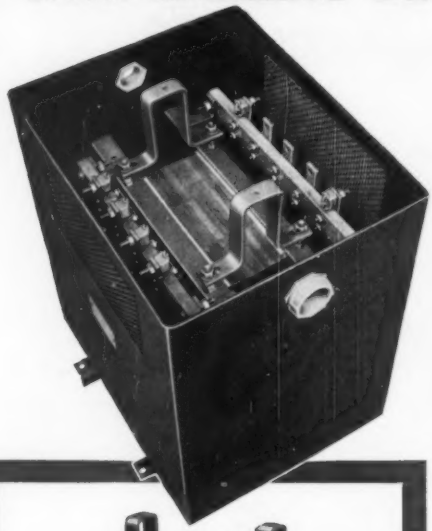
SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

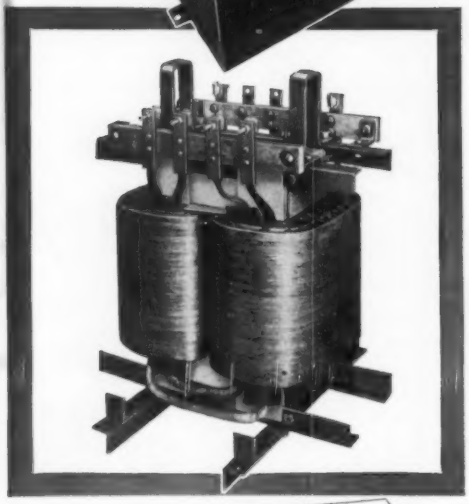
WAGNER TRANSFORMERS
...The choice of leaders in industry

SAFE POWER

Low Cost, too-

WITH Wagner DRY-TYPE TRANSFORMERS





The safest, most economical and efficient way to reduce power distribution costs and to put the right voltage in the right place is to install Wagner dry-type transformers. They provide steady voltage with minimum line losses. They do not require the construction of fire-proof vaults — even in locations where fire hazards are present. They are compact and light in weight — easy to install and easy to move when changes are necessary.

The typical AE, 15 to 100 kva transformer, pictured with core and coils at left, is cased in sheet steel with an easily removable cover. It is equipped with high and low voltage terminals to which incoming leads are connected, utilizing solderless connectors provided for that purpose. High and low voltage external connections are eliminated since ample space and suitable provisions are made for connecting leads inside the transformer.

Twenty-nine branches, located in principal cities, are at your service for consultation on your transformer problems and offer speedy, nationwide service facilities. For full information on Wagner Power and Distribution Transformers, write for Bulletins TU-180 and TU-181.

General purpose dry-type transformers are available in ratings from ¼ to 200 kva, 600 volts and below, single-phase, two coil, Type AE; and from 3 to 300 kva, 600 volts and below, three-phase, two coil, Type AP. Type AA auto-transformers are also available.

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
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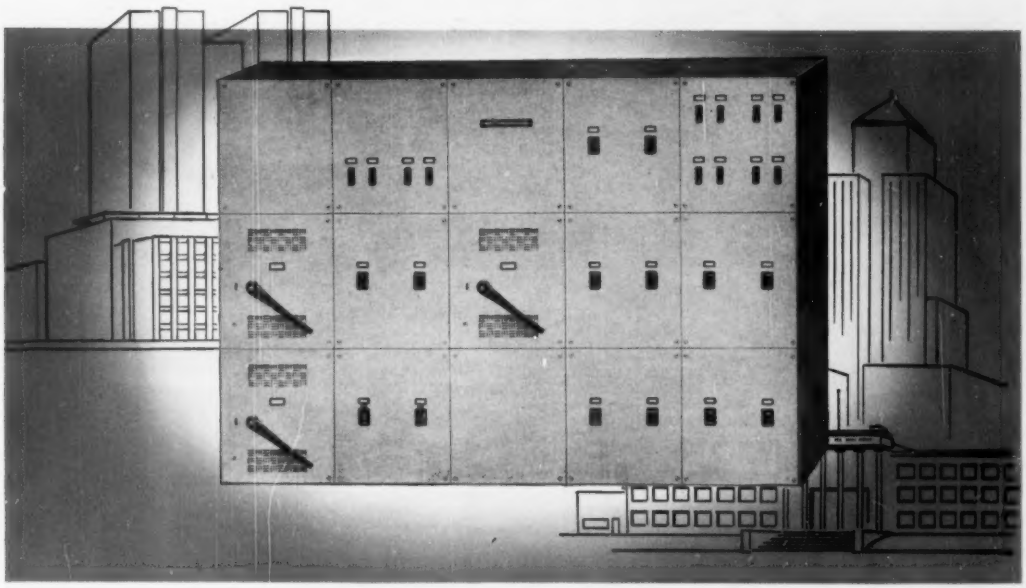
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 29 PRINCIPAL CITIES

TM-4

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



New *STANDARDIZED* Building-type Switchboards

Cut Planning Time

Switchboard planning for offices and other commercial-type buildings is greatly simplified with the NEW Westinghouse *Standardized* Building-type Switchboard.

Unitized construction eliminates special design problems . . . yet their complete flexibility gives you all the advantages of "custom built" units.

Factory-assembled, wired and tested, they may be shipped as a single unit and quickly placed in service. However, if desired, they can be shipped as individual units and quickly reassembled on the job.

They are specifically designed to feature low-cost circuit breaker protection by means of Westinghouse nofuze "De-ion" type AB circuit breakers for ratings through 600 amperes. For ratings above 600 amps, Westinghouse type DA breakers are used. Get the complete story. Call your nearest Westinghouse office or write for D. E., 30-990, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40380

Westinghouse

SWITCHBOARDS

NEW ALLSTATE INSURANCE BUILDING

Illuminated throughout with ELECTRO'S *SKYLOUVER*

Electro's exclusive "one-man" SPEEDY HANGER saved hundreds of installation man-hours in this 3,392 fluorescent unit project.

Chicago's first multiple story office building built since the war installs prize-winning ELECTRO "SKYLOUVER" luminaires with translucent polystyrene louvers and side panels for . . . .

- **Top Lighting Efficiency**
- **Economical Maintenance**
- **Lower Installation Cost**
- **Outstanding Appearance**

New Home of Allstate Insurance Co.
Architects: Carr & Wright
Consulting Engineer: Robert Hattis & Co.
General Contractors: B-W Construction Co.
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ELECTRO MANUFACTURING CORPORATION

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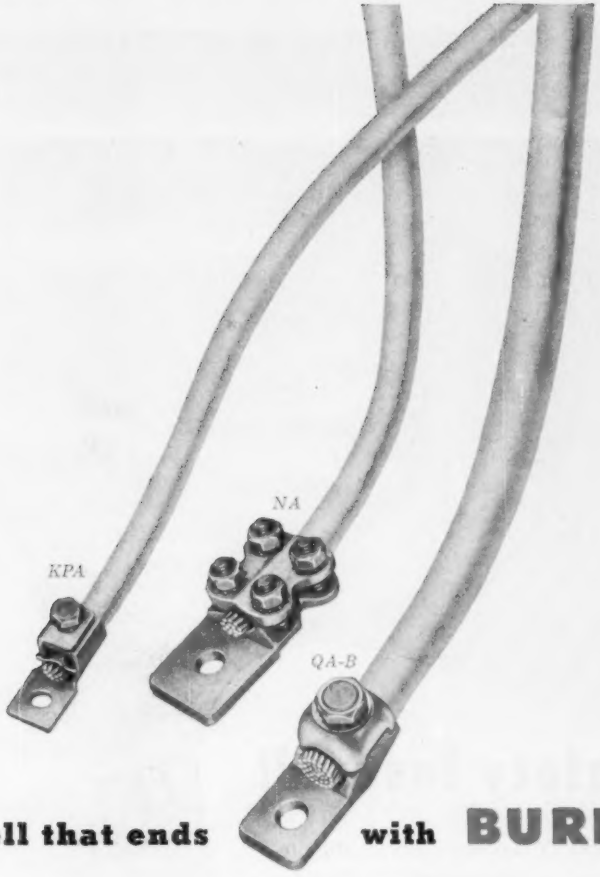
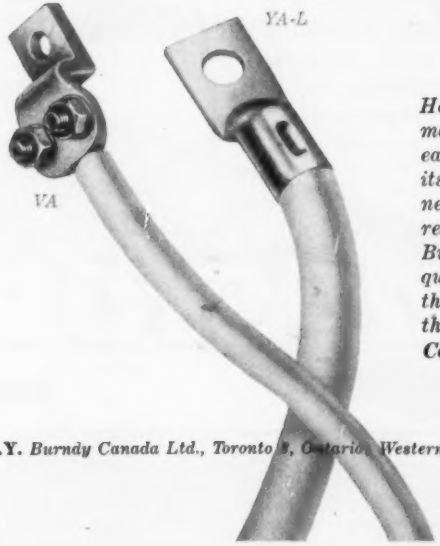


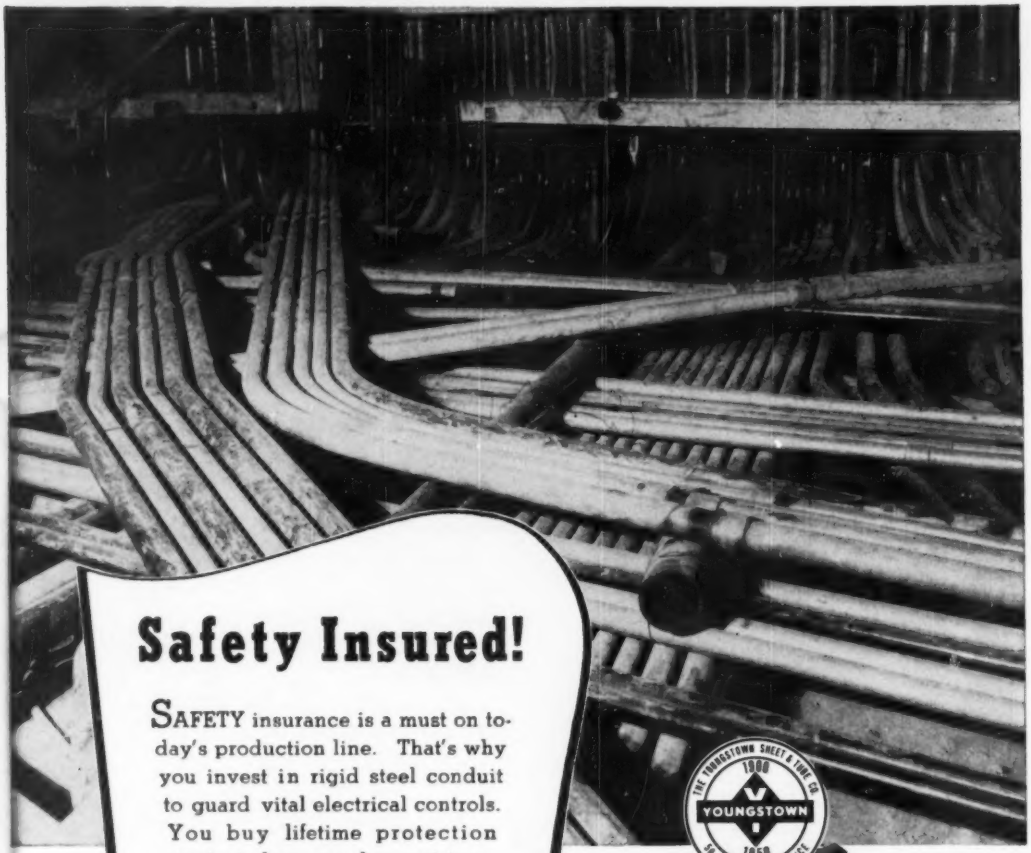
all's well that ends with BURNDY



Here are just a few of many Burndy terminals—each one designed to do its specific job... faster, neater, better!—each reflecting the famous Burndy "engineered" quality—each one proof that, for best results in the end, it pays to ***Connect with*** **BURNDY**

BURNDY, New York 54, N.Y. *Burndy Canada Ltd., Toronto 8, Ontario. Western Branch: Vernon 11, California*

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*



Safety Insured!

SAFETY insurance is a must on today's production line. That's why you invest in rigid steel conduit to guard vital electrical controls. You buy lifetime protection against damage by moisture, vapors, dust, vibration, shock and explosion. When you specify Buckeye you specify safety.

THE YOUNGSTOWN SHEET & TUBE CO. 1900 YOUNGSTOWN 1950 50 YEARS OF SERVICE

Youngstown

BUCKEYE CONDUIT

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Manufacturers of Carbon, Alloy and Yoloy Steel

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Lighting Solutions at Your Fingertips

New G-E lighting solution sheets help you lay out jobs, clinch sales!

IF you've ever wanted a clear, simple solution to a lighting problem, these new sheets are for you! If you've ever wanted some easy-to-understand lighting pictures and diagrams to show specific prospects, in terms of their own businesses, these sheets are your answer! They cover many types of installations—stores, factories, offices, schools, public buildings and others, and they're all punched and ready for your notebook.

Each sheet has a large photograph of an installation, a diagram giving all important dimensions, and a short description of equipment and the results achieved.

A set of these handy solution sheets is yours for asking, at no cost or obligation of any kind. Just fill in and mail this coupon today.

FREE LIGHTING SOLUTIONS

General Electric Co., Lamp Dept., Div. 166-ECM-3, Nela Park, Cleveland 12, Ohio:

Please send me at no cost or obligation a selection of your free lighting solution sheets.

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You can put your confidence in—

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Cables run COOLER... in TRANSITE DUCTS

. . . reducing copper losses

. . . increasing current capacity

. . . prolonging insulation life

HERE'S HOW to reduce copper losses . . . increase current carrying capacity . . . and prolong insulation life—run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed.

In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%

Earth Temp. ambient—20 C	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric Loss (C)	1.9	2.1
Allowable Rise for Copper Loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	100.

Johns-Manville *Transite Ducts* **"KORDUCT"— for encasement in concrete**

"CONDUIT"— for use exposed and underground without encasement

This Free Booklet

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HERE'S THE STORY OF ELECTRICAL INSULATION RESISTANCE
For Practical Men
This little booklet covers insulation resistance testing in simple language; packed tight with maintenance hints
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. . . offers practical suggestions on how to . . .

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Five minutes' reading time will give you a practical slant on the simplicity and yet highly efficient and profitable aspects of periodic testing of the insulation in your electrical equipment.

You'll find such typical down-to-earth questions as:

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What makes it go bad?
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Smithcraft LIGHTING DIVISION, CHELSEA 50, MASSACHUSETTS

Director — the outstanding fluorescent lighting "element" of the year. Thirty-one variations are available (from four-foot bi-pin to eight-foot Slimline), thus permitting the use of the exact unit to fit the particular needs of stores, banks, institutions and similar locations. Director can be supplied for two, three, four or six lamps, with the six-lamp eight-foot Slimline model providing an unobtrusive louvered "area-of-light" source of over 24 square feet. Where and when needed, Smithcraft "built-in spots" permit, for the first time, the addition of accent lighting without disturbing the original effectiveness of layout.

Full information on the Director, as well as other Smithcraft commercial and industrial fixtures, may be obtained upon request. Write today for your copy.

Finish the Job Right

INSTALL A SANGAMO TIME SWITCH

SANGAMO QUALITY ACTUALLY COSTS LESS!

It's sound economy to buy the *best* time switch for your installation. The *overall* cost can be far less, in spite of the slightly higher price. You save labor costs on man hours spent in service calls due to faulty time switch operation . . . you protect the reputation of your work . . . you make satisfied customers who pave your way to increased business!

There's a time switch to meet your exact needs in Sangamo's complete line of *high-quality* time switches. The Type L, for example is a heavy-duty versatile unit for continuous service under even the most severe operating conditions. It can be supplied with a number of control features such as an omitting device, advanced time device, or an astronomic dial for automatic sunset to sunrise operation. All these features are also available on the Type W, which is a switch that does not have to be reset after current interruptions. The Types L, W, and all other high-quality switches of the complete Sangamo line are stocked by your electrical wholesaler.

NEW TIME SWITCH CATALOG . . . Ready for You!

Every Time Switch user will find practical answers to time control problems in Sangamo's new 16 page Catalog No. 1010A. It contains complete information, specifications, wiring diagrams, and prices—everything you need to help you choose the best possible time switch or timer for your next installation. Write for your copy today.

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ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

SANGAMO
Interval Timers

For attic fan and air conditioning control. Type T for wall or switchbox mounting. Type TJ (with plug-in cord) for portable convenience.

IT WON'T BREAK

if it's a new

O.Z.

ALL-BAKELITE BUSHING!

BOUNCE IT

Bounce an O. Z. All-Bakelite Insulating Bushing hard, on a concrete floor — it rebounds good as new. Add to its superior strength* these extra features and you've got a bushing that's best by any test!

- **Smooth rounded edges completely protect wire insulation during pulling and when in service.**
- **Clean, deep threads let you spin-on the bushing with a twist of the wrist.**
- **Ribbed outer surface provides a grip for slippery hands and permits tapping with a screw-driver.**

O. Z.'s New All-Bakelite Insulating Bushings are fully approved by Underwriters' Laboratories, meet all requirements of the National Electric Code.

Try a few, bounce 'em, treat 'em rough and you'll be convinced there are no all-Bakelite bushings better suited to the job . . . none so economical to use as O. Z.'s.

Available in sizes from ½ inch to 6 inches, cost no more than ordinary Bakelite bushings. Samples on request.

*56% stronger over all than all other leading all-Bakelite bushings actually tested by an independent laboratory.

CONDUIT FITTINGS • CABLE TERMINATORS
CAST IRON BOXES • GROUNDING DEVICES
SOLDERLESS CONNECTORS • POWER CONNECTORS

Buy O. Z. and you'll see why Engineers say, "They're OK if they're O.Z."

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262 BOND STREET • BROOKLYN 2, N. Y.

4899

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Westinghouse

Don't be a FIXTURE PICKER!

They'll never find a "bargain in lighting" by "picking fixtures". Yet you meet hundreds like this every day. And so do we.

No *one* fixture will solve all lighting problems.

There are, in fact, literally thousands of luminaires engineered to do specific jobs. One may be the right answer—or it may take two or three.

Good lighting combined with practical economics takes the services of a qualified lighting engineer.

Whether you plan lighting, buy lighting or install lighting, the services of a Westinghouse lighting engineer are available to you. J-04280

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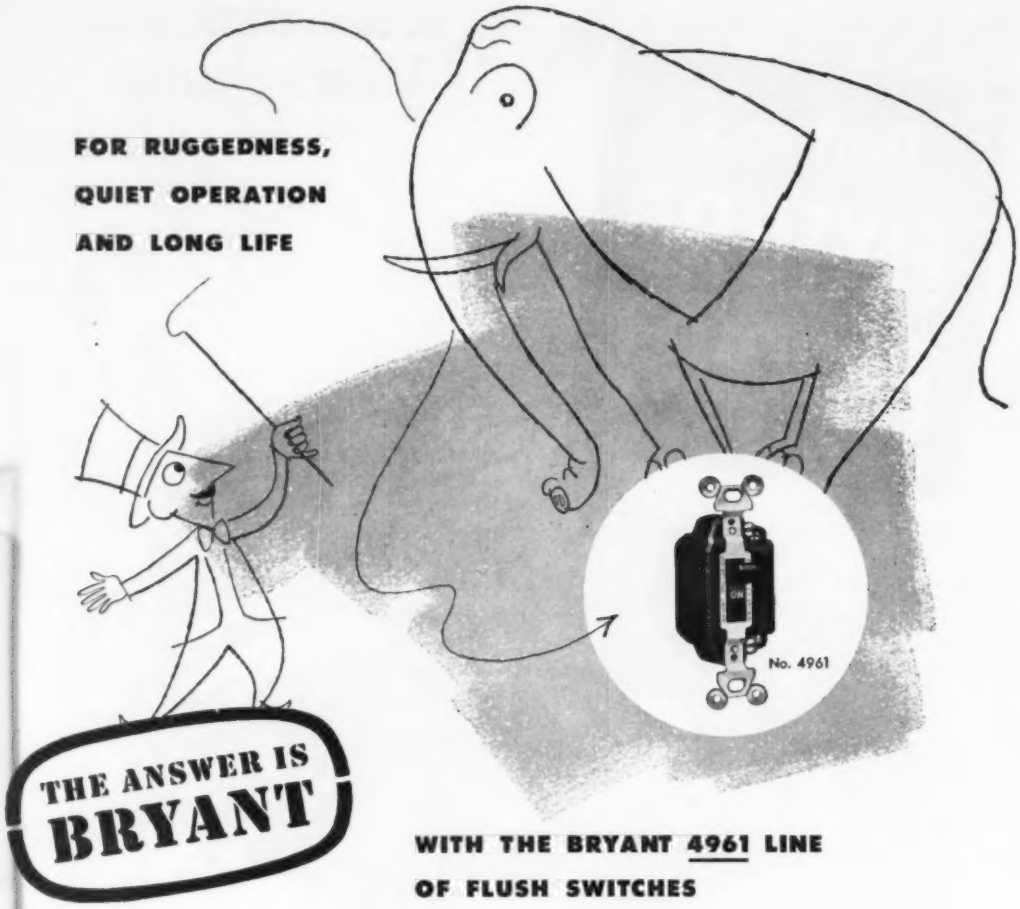
PLANNED LIGHTING PAYS

FOR RUGGEDNESS,
QUIET OPERATION
AND LONG LIFE



THE ANSWER IS BRYANT

WITH THE BRYANT 4961 LINE OF FLUSH SWITCHES

For commercial and institutional installations requiring a switch that gives long, uninterrupted service under the most exacting load conditions, specify the Bryant 4961 line of Flush Switches.

A shallow, heavy composition cup (1⅛ inches deep) provides ample strength and assures quiet operation. These switches are "T" rated at 10 amperes, 125 volts—5 amperes, 250 volts.

The mechanism is completely enclosed and insulated from the yoke. These devices are top wired and easily installed.

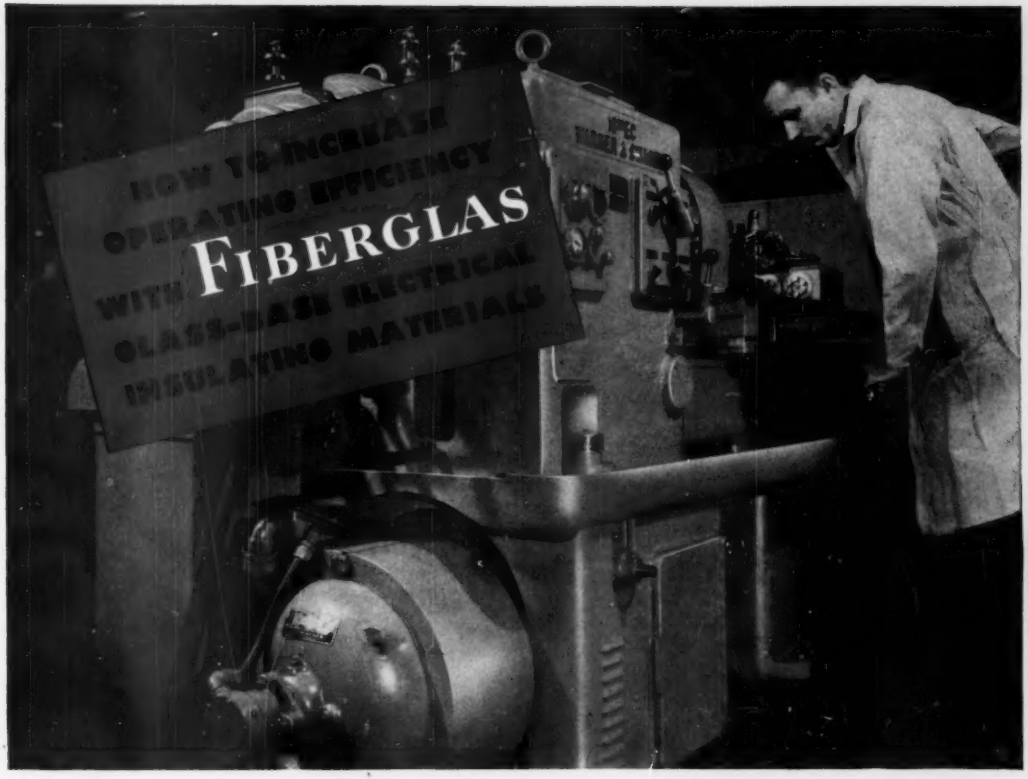
The 4961 line meets all specifications and is available in single and double pole, three and four-way types with brown or ivory handles. These devices are also available with lock and momentary contact features and stamped steel handles.

Listed as Standard by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY
Bridgeport 2, Connecticut
CHICAGO • LOS ANGELES

BRYANT
SUPERIOR WIRING DEVICES

SPECIFY BRYANT DEVICES FROM YOUR ELECTRICAL WHOLESALER J-9983B



FIBERGLAS *Yarns*

HELP INCREASE PRODUCTION! LOWER METAL WORKING COSTS!

"A new approach to machining nonferrous metals!"

That's how Warner & Swasey Company, Cleveland, Ohio, describes its Electro-Cycle turret lathe.

To produce a lathe that would increase production and lower costs, Warner & Swasey uses insulating materials made with Fiberglas* yarns in the main drive motors. The result: under ideal conditions, an increase of 40% in reversal capacity over motors using organic-base insulations.

In addition, Fiberglas glass-base insulating materials in these motors guard against damaging thermal shocks, wide variations in temperatures of the windings, metal chips, and coolants.

If your electrical equipment must operate under unusual conditions . . . or if you want trouble-free normal operation . . . *specify Fiberglas yarns.*

Owens-Corning Fiberglas Corporation, Dept. 856, 16 East 56th Street, New York 22, N. Y.

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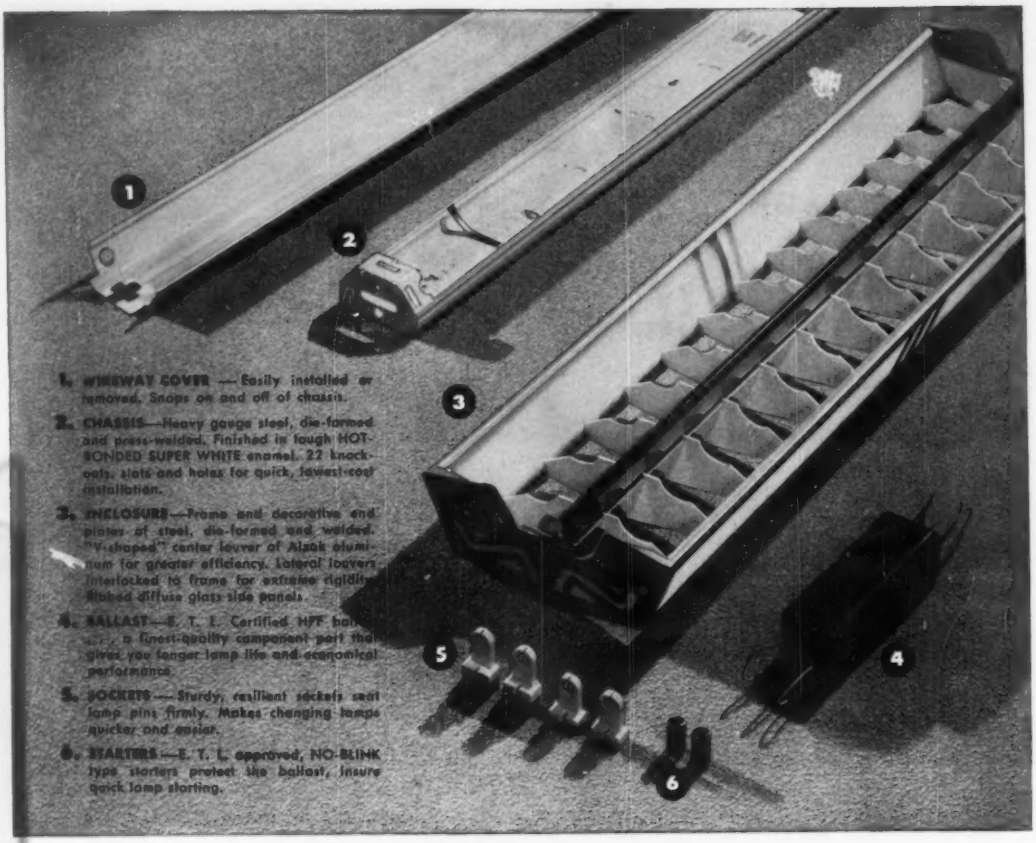
OWENS-CORNING FIBERGLAS *Yarns*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1. RACEWAY COVER — Easily installed or removed. Snaps on and off of chassis.
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3. ENCLOSURE—Frame and decorative end plates of steel, die-formed and welded. "V-shaped" center louver of Alzak aluminum for greater efficiency. Lateral louvers interlocked to frame for extreme rigidity. Ribbed diffuse glass side panels.
4. BALLAST—E. T. L. Certified HPF ballast, a finest-quality component part that gives you longer lamp life and economical performance.
5. SOCKETS — Sturdy, resilient sockets seat lamp pins firmly. Makes changing lamps quicker and easier.
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THE DAY-BRITE "VIZ-AID" PUTS ITS PARTS ON THE TABLE

Judge a book by its cover? Judge a lighting fixture by its appearance alone? No! Not if you want to be sure — *dead sure* — that the fixture you select will give you years of trouble-free, economical performance.

It's insides—*quality insides*—plus expert engineering, sturdy construction, durable finish and low-cost maintenance features that make the "Viz-Aid" such an outstanding value. Compare the "Viz-Aid" with any other fixture in your own "take-it-apart" test. Be sure! See for yourself how every inch of the "Viz-Aid" is quality built—*inside and outside* — to give you *real* economy through long, efficient service.

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Missouri. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario. Distributed nationally by leading electrical wholesalers.

The Day-Brite "VIZ-AID"—available for two 40-watt lamps, two 85-watt lamps and four 40-watt lamps.

"DECIDEDLY BETTER"
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Lighting Fixtures

ONLY QUALITY IS ECONOMICAL

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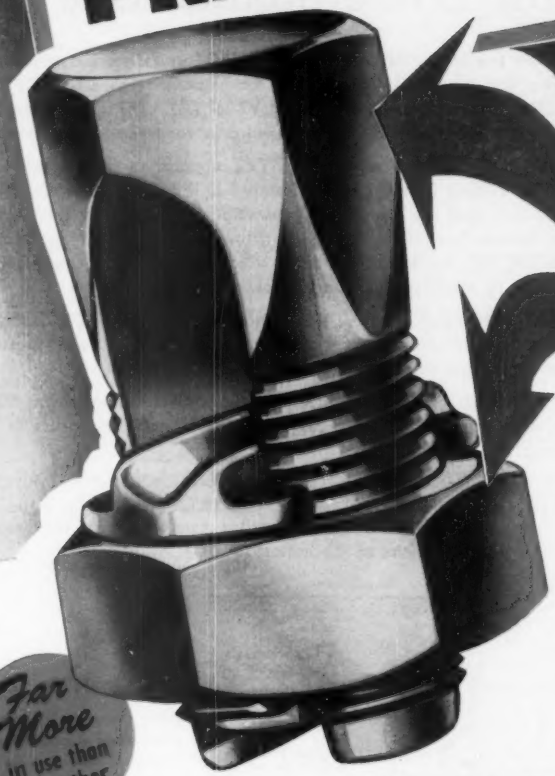
Approved by UNDERWRITERS LABORATORIES

Here's the MOST PRACTICAL design



LARGER SURFACES

to grip with wrenches from ANY ANGLE—using either a socket or open-end wrench.

MAXIMUM CONTACT provided by V-groove; conductors protected by bevelled slot.

PRECISION MADE, with rigid inspection. Smooth accurate threads assure maximum pressure—permanently maintained.

For taps, dead-ends, parallel connections, etc., in any location. Can be furnished in bronze or aluminum. Reusable over and over.

Far More in use than any other

Sold by Leading Wholesalers

With or without retainer.

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THE *Complete* LINE OF CONDUCTOR FITTINGS

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CRESCENT
IMPERVEX TRENCHWIRE

For Lowest Cost Underground Use

● **CRESCENT IMPERVEX TRENCHWIRE provides the LOWEST COST, PERMANENT underground installation for services from power line to meter, for connecting several buildings from the same service, as on FARMS, ESTATES and INSTITUTIONS and for STREET, AIRPORT, BALL PARK, DRIVE-IN THEATRES, and other outdoor lighting and power circuits. Also extensively used by INDUSTRY in ducts for underground power circuits.**

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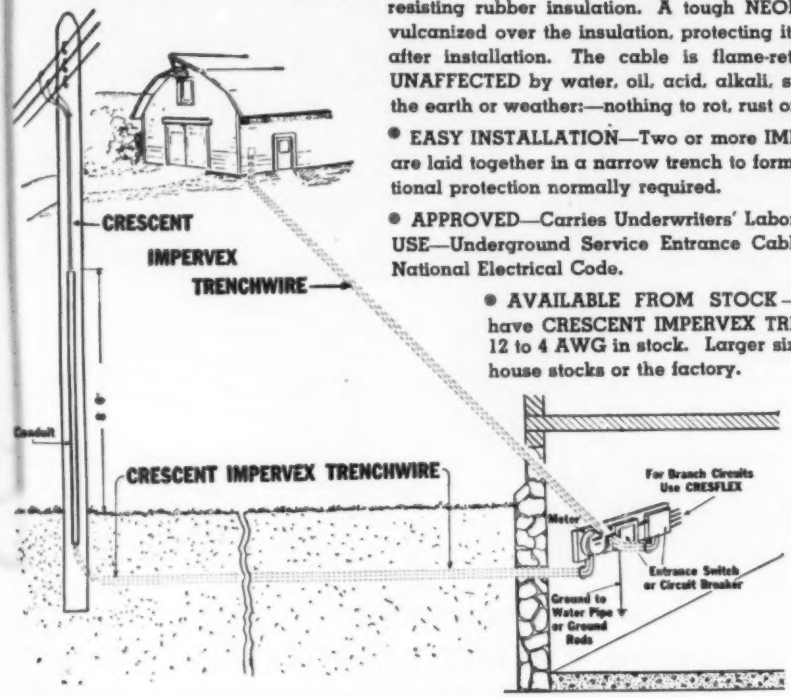
● **APPROVED**—Carries Underwriters' Laboratories' Labels as TYPE USE—Underground Service Entrance Cable, and conforms to the National Electrical Code.

● **AVAILABLE FROM STOCK**—Electrical wholesalers have CRESCENT IMPERVEX TRENCHWIRE in sizes No. 12 to 4 AWG in stock. Larger sizes available from warehouse stocks or the factory.



● **BULLETIN No. 451**

giving technical information on selection of proper size of conductor, etc., will be furnished on request.

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WIRE & CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

MARCH . . . . *at a Glance*

Range Wiring

Among major industry problems is that of providing sufficient additional circuit capacity for high current appliances. Ranges, water heaters and dryer installations are of particular importance at the moment. In a cooperative engineering program, Detroit range wiring is installed as a volume operation by specialty contractors. Through volume and specialized wiring design, efforts are made to hold installation costs at a low level. With the cooperation of the contractors, Gus Eckel's article is a thorough study of the Detroit electrical industry's approach to the range wiring market. The story begins on page 53.

Listing Take-off

The systematic listing and tabulation of the dozens of individual counts and measurements of estimating is one of the critical points where errors can be forestalled by planned method. Forms should meet estimating needs, procedure for tabulating data should be methodical, and provision should be made for frequent check points. Listing methods for take-off is reviewed in the third of our series on "How to Estimate Electrical Work," page 56.

Who's To Blame?

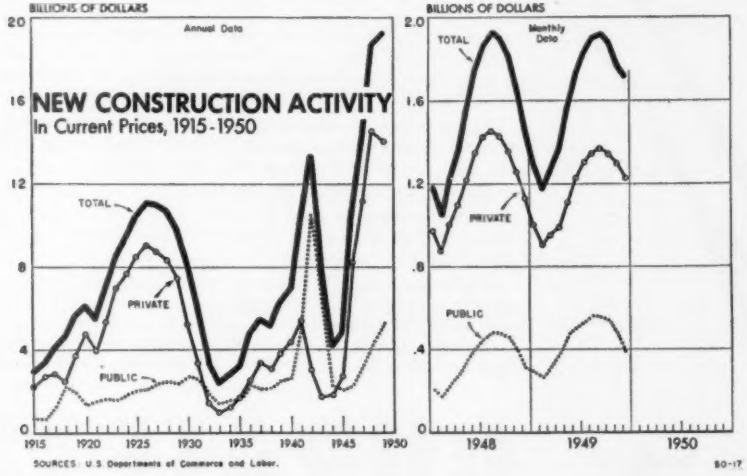
The problems of cooperation in the adequate wiring program by electrical contractors has rarely been discussed with such complete frankness as the panel discussion between F. E. Davis, Commonwealth Services, Inc. and H. L. Scott, Scott Electric Company, Corpus Christi, Texas, at the Adequate Wiring Conference in St. Louis last month. We are presenting this discussion in "A. W. Cooperation," page 66 in this issue. While the remarks are somewhat abridged from the full argument presented at the conference, we have made every effort to cover all the major points presented.

Unit Equipment

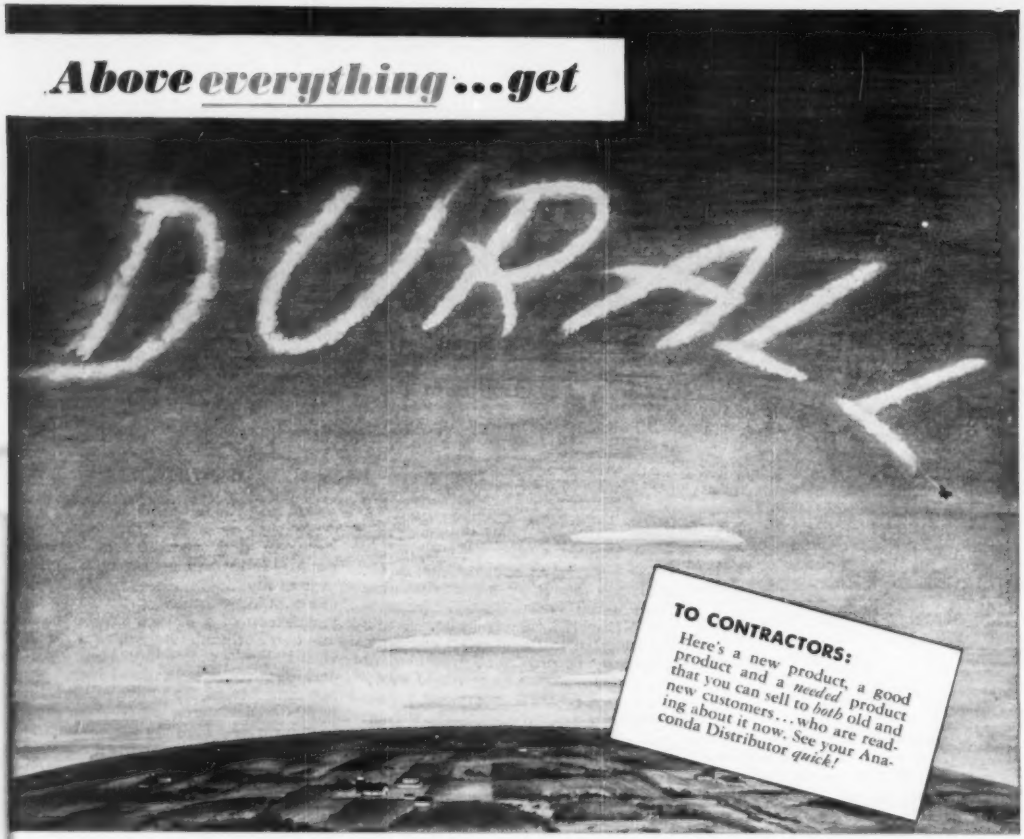
Among the notable advances in ventilating and comfort cooling apparatus in recent years has been the development of "package" apparatus. By convenient installation and ready adaptability to a great variety of ventilating and cooling problems, the new equipment has greatly broadened the available market for summer comfort control. Beginning on page 58, "Comfort Control With Unit Equipment" reviews some of the opportunities in this field for electrical men, and describes some current equipment developments.

Outdoor Lighting

Sports and spectacular outdoor lighting is rapidly setting new standards of illumination intensities. Typical of outdoor lighting progress is the installation of a 550 kw lighting system at a Portland, Oregon, race track. With 19 banks of floodlights on 10 percent over-voltage, Portland Meadows is claimed to be the nation's brightest lighted track. The story, "Portland Meadows Sets Lighting Pace," begins on page 64. High intensity outdoor lighting installations have been largely devoted to major sports. Such installations are excellent examples of what outdoor lighting can do. A great market opportunity in outdoor merchandising could easily use similar development.



Above everything...get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TO CONTRACTORS:
Here's a new product, a good product and a needed product that you can sell to both old and new customers... who are reading about it now. See your Anaconda Distributor quick!

...THE WORRY-PROOF BARN WIRE

Anaconda Durall Cable, the new Underwriters approved, completely reliable barn wire, sets a new altitude record for quality combined with rugged down-to-earth, long-lived economy. All the freedom-from-worry that goes with it is the biggest bonus any farmer could want.

Durall is a non-metallic-sheathed wire with a rubber-like insulation of Neoprene and a heavy protective jacket of the same tough, flame-resistant material . . . with no fibrous coverings to rot or fray.

Durall is strong electrically and physically. Both insulation and jacket are highly resistant to moisture, mold, rot and animal wastes. Durall will not support flame, is proof against most acids, alkalis and oils. This is a truly fungus-resistant cable.

The Underwriters' Laboratories, Inc. have approved DURALL as a "Non-metallic-sheathed cable having adequate fungus-resistant, and other necessary properties for use in cow barns and *other* locations where it would be subjected to conditions of heat, cold, moisture, corrosive fumes and fungus." Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 49456

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CIRCUIT PROTECTION

OVERCURRENT PROTECTION is inexpensive and virtually foolproof. Operation of fuses and circuit breakers are so certain that unless the overcurrent device has been deliberately bridged, it can be counted on to save the premises from almost any degree of electrical failure.

SUCH PROTECTION is much to the credit of our engineers and laboratories. But the reliability and precision of overcurrent devices covers a multitude of electrical sins. How often do they operate to clear a circuit, not from accident or abuse, but from overloading by perfectly healthy utilization devices?

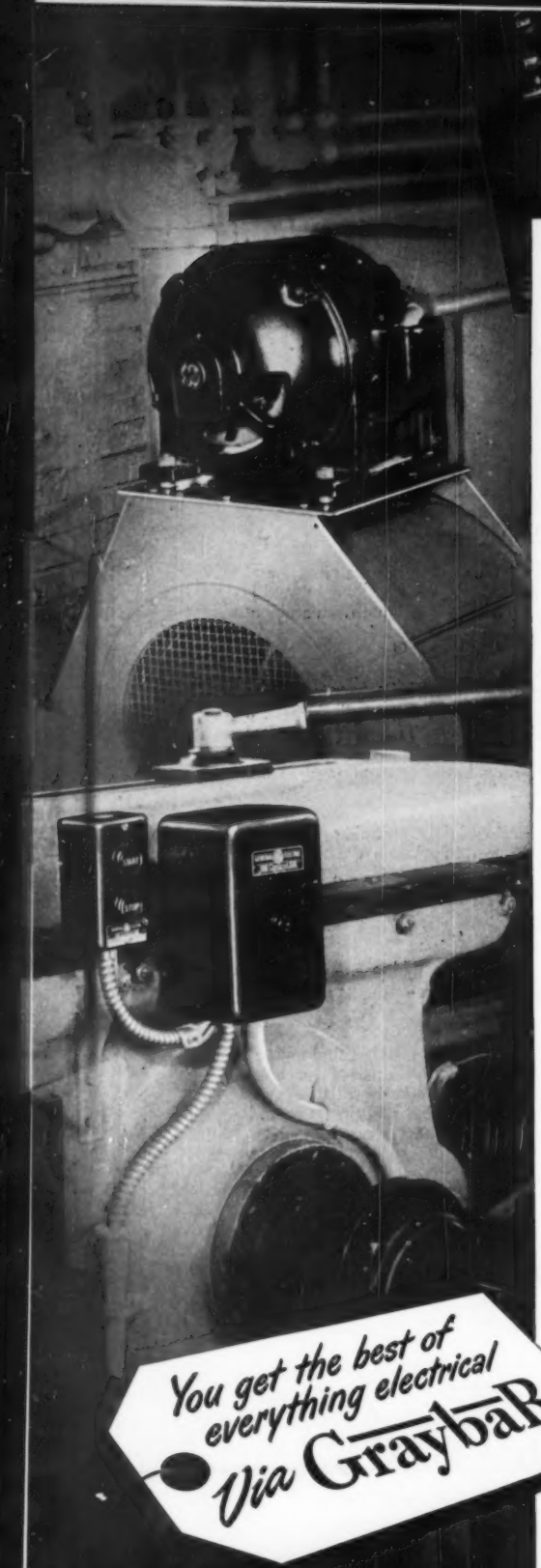
DESIGN OF MOST technical features of building is based upon an operating range well short of ultimate capacity. Floor loading, elevators, heating plants, wind resistance and a host of other features of our surroundings have a substantial margin of safe operation beyond design ratings. Too many electrical systems, however, are designed for operating loads very near ultimate circuit capacity. Probable and readily predictable overloading is too often allowed to fall well beyond the capacity of the overcurrent device.

AGGRAVATING THE PROBLEM is the continuing growth of demands upon existing wiring systems. Connected loads approach the maximum circuit capacity. Extension of feeders and branch circuits add provisions for accessibility without additional capacity. The result is more and more frequent operation of overcurrent devices though no actual faults occur.

IN ESSENCE, overcurrent protective devices are called upon to serve as current limiters to cover inadequate design. And inadequate design is almost always the result of accepting the maximum code circuit rating as a practical operating rating.

IN NO OTHER ENGINEERING applications do we find normal loading at or near the permissible maximum. There is no good reason for it in electrical work. Circuit capacity design to 50 percent of maximum is entirely practical and would provide under normal utilization a reasonable margin. It would allow overcurrent protective devices to operate as they should to clear faults—not to limit proper and predictable use of the system.

Wm. F. Stuart



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Please send me copies of the two booklets "Simplified Guide to the Selection and Application of Commonly Used Types of A-C Motor Controls" and "The Biggest Control Story in Years."

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You get the best of everything electrical
Via Graybar

JOB TICKETS *are sorted geographically for truck routing. Contractor's superintendent does this each morning while*

TRUCK CREWS REPLENISH *material supplies for the day's rounds.*

RANGE WIRING IN DETROIT

Volume operations of specialty contractors plus prudent wiring requirements accelerate range installations and minimize costs. The Detroit electrical industry's approach to the range wiring market.

By August Eckel

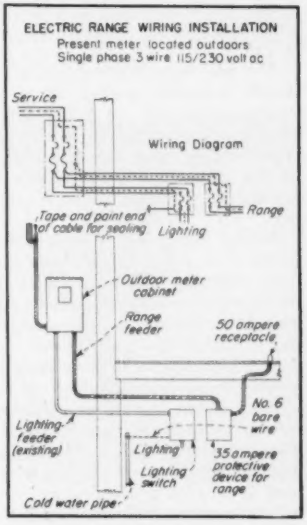
THE automotive capital of the world is rapidly becoming an "Electrical Living City". Through the cooperative efforts of the local electrical industry, thousands of electric ranges, water heaters, clothes dryers and other major appliances are going into Detroit area homes annually. Much of this success can be attributed to the nominal cost of installations effected through reasonable wiring requirements, pooling of dealers' installations and specialty contractor participation. The net result is lower unit costs due to volume production.

This story really starts back in the depression days of the early thirties. Electric cooking progress was slow, due to slow speed of ranges and initial cost of the range in comparison with other types of stoves. The local utility had been studying this field for some time and decided to encourage the building of a range incorporating faster units, better oven construction built by mass production methods, and priced to attract the average customer.

The public had already suffered a reduction of earning power and the building of new homes had almost vanished, which left the old houses as the only mass market. The minimum wiring installations found in most of these old houses would need revamping to use a range and it was clearly evident that unless the means could be found to standardize the installation in the interest of economy, efficiency and customer acceptance, the whole effort might prove fruitless.

The installations, both for dealer sales and utility sales, were coordinated through the utility, which acted as a clearing house for wiring orders by contracting for a large volume of jobs. This plan has been in use for the last 17 years.

Last year the utility asked for bids on a minimum of 5,000 range, 500 water heater and 500 clothes dryer installations. To qualify, bidders must be equipped to install at least 30 units per day, and quote unit installation



RANGE WIRING STANDARD *installation sheet. Note that existing service facilities, from load side of meter, need not be disturbed.*

WHILE ONE MAN *installs the service entrance cable and meter boxes for two-family house . . . . . .*

THE OTHER ELECTRICIAN *tackles the range switch and circuit. Existing service equipment is not disturbed.*

RANGE OUTLET *is installed in this second-floor kitchen (note gas pipe cap at right) while . . . . . .*

prices for each appliance type. The low bidder, if qualified to perform, is awarded the contract and his unit figures become the standard installation prices under the contract.

In 1949 the price for range wiring was $37.50; for dryers, $36.00; and for water heaters, $30.75, exclusive of plumbing. These prices cover complete installation.

Wiring jobs which qualify under these prices are restricted to residential installations up to and including four family flats. Unusually large homes or those requiring special installations are not accepted at these prices.

For new home construction, a different procedure applies. Here, the contractor wiring the home usually installs the wiring for the range, water heater and clothes dryer, which is the most efficient and economical method of providing adequate capacity.

Wiring methods have an important bearing on any electrical installation price affecting both labor and material costs. Hence, the wide cost variation throughout the country where different installation practices are followed. Contributing to the economical pattern of the Detroit activity are two distinct features: (1) recognition of wiring methods approved by the National Electrical Code; and (2) use, without alteration, of existing wiring that is in good mechanical and electrical condition. Every installation must be approved by local electrical inspection authorities.

Standard Detroit practice is to use conventional service entrance cable and non-metallic sheath cable for range, water heater and clothes dryer installations.

Standard utility wiring specifications permit the use of service entrance cable to the meter cabinet. Existing wiring from the meter cabinet remains unchanged with a separate new range circuit being tapped to the load side of the meter. The same is true of water heater installations except that connections are made to both the line and load side of the meter to provide dual-rate service (off-peak and standard). Clothes dryer circuits may be connected to the line side of the lighting switch, provided service is adequate. Otherwise the circuit is taken all the way back to the load side of the meter.

A study of the diagrams will show that, with the exception of a heavier service entrance, existing facilities need not be disturbed to make these appliance installations.

Contractor Operations

Reid Electric Company of Highland Park, Michigan (Detroit suburb) is one of several specialty contractors who do this work and has through some ten years of range wiring specialization built up an organization capable of making upwards of 6,000 installations per year. Developed in 1936 by Mr. and Mrs. Harry L. May, this activity has grown in efficiency with the years. Upon Mr. May's retirement in 1947, the business was purchased by E. E. Herndon, former chief electrical inspector of Detroit, and one-time employee of Reid Electric Company. Now the Reid Company operates more than a dozen fully equipped trucks in Detroit and 16 suburban areas; makes about 50 percent of all range, water heater and clothes dryer installations under the utility contract arrangement. Other installations are made by similar specialty contractors operating direct for dealers and other nationally known mail order and chain merchandising outlets.

Close cooperation between utility and contractor is essential to insure prompt customer connections when installations are made involving service changes. Customers notify the utility when they want a range or other appliance installed. The utility advises them what day the installation can be made —to tie in with service truck schedules—and then notifies the contractor

ELECTRICIANS CARRY *handy tool tray for all tools and wiring accessories needed on the job. Electric tools are used when goin' gets tough.*

FINISHING TOUCHES *are put on service change. Existing service conduit under left meter is unchanged.*

a day in advance of promised installation date.

Reid's office force of four girls transfers these telephoned notices to order forms which are then placed in a job rack for the next day's operations. Early the next morning, while all trucks are being checked and replenished with materials, the general superintendent sorts out the job orders. Assignments to truck crews are made according to geographical location, thus maintaining minimum operating areas for each truck.

With the day's route established and order forms in hand, each two-man crew (I.B.E.W. journeyman) starts out on its rounds; maintains mid-day telephone contact with the office to report progress and receive further instructions or emergency orders. At the completion of each job, the electrician inserts quantities of material and labor hours on the specially printed forms, listing all material items that might be used on this type of work. These are turned in at the close of each day for costing. Normally, a two-man crew makes four standard installations (range, water heater or dryer) per day and fills in with small repair or trouble-shooting jobs for the utility. The outdoor metering program and replacement of broken service brackets, etc., are included in the "fill-in" when appliance sales slow up.

Experience and teamwork combine to produce the on-the-job efficiency reflected in Reid's operations. Most of the crew have been doing this work for 10 years or more and know residential construction thoroughly. Hence, there is little hesitation about establishing circuit runs. After analyzing job conditions, one man immediately starts on the service change; the other tackles the indoor work. Upon completion and testing, the crew goes on to the next job. Lost time between jobs is held to a minimum by careful routing of the trucks.

Standard procedure is for the customer to pay the utility direct for installation costs he must bear. Reid Electric bills the utility twice a month for all installations made in that period. Economies in operating overhead result, since 24 invoices cover a year's installation of 6,000 or more units. Extremely accurate costs are kept for each job. This is a *must*, for this data, combined with office and truck operating overhead, forms the basis of establishing new installation costs when the project is up again for bidding.

This approach to range wiring in old houses and others with inadequate capacity stimulates other major appliance sales. The utility watches the trend of appliance sales through six dealer contact representatives from its Sales Department and gears its promotional efforts so as to keep the volume at an even flow of jobs.

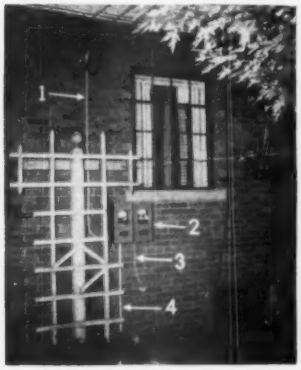
The volume-contract plan has been used for many years to give consumers the benefits of the lower unit costs that contractors can offer through volume material purchases and coordinated volume operations.

APPLIANCE INSTALLATION

"Range Wiring in Detroit" is an accurate job of reporting in a highly controversial field. The methods and materials used in the Detroit operation would not be permitted under electrical codes and ordinances in effect in some other communities.

We do not intend to contribute here to arguments for or against any local wiring requirements. This article tells how Detroit is finding a way to provide power to high current appliances installed in existing homes. In our opinion, successful cooperative industry efforts to serve the public are always important.

The problem of installing high current appliances economically is pressing upon the industry in every major city. Its solution is not necessarily to be found in any one type of wiring system. The core of the Detroit operation is a planned volume approach to the job.—W.T.S.



COMPLETED SERVICE *for a two-family home. (1) Service entrance cable; (2) meters for the two floors; (3) range circuit from second floor meter; (4) existing service conduit.*

ELECTRIC WATER HEATER *circuit is added to existing service. Cable goes from new time switch cabinet at right to two-circuit water heater control cabinet in basement.*

CLOTHES DRYER *switch (cover off) is added to existing service equipment. Circuit was carried back to outdoor meter. Existing water heater control is above.*

How To Estimate Electrical Work—III

LISTING INCLUDES systematic forms carefully developed to meet estimating needs.

LISTING INCLUDES a planned and logical procedure for tabulating the data.

LISTING INCLUDES appraisal of take-off data in terms of actual material needs.

LISTING INCLUDES provisions for cross checks at known points to forestall errors.

By W. T. Stuart

AS material is counted and scaled from the plans, they must be listed in some convenient and error-resistant form. Some estimators find columnar pads with 10 to 12 columns satisfactory for branch circuit and feeder take-off listing. Good printed forms are available, however, from the National Electrical Contractors Association and the Midwest Electrical Council, which have been carefully developed and skillfully prepared to meet the specific needs of electrical estimating. They are inexpensive and far superior to makeshift listing sheets.

Printed forms also have the advantage of distinctive appearance, which helps to avoid accidental loss or destruction of important data. In some shops all estimating sheets must be accounted for with any forms used in error or superseded cancelled but retained in the estimate folder.

As in the take-off, listing should follow a systematic pattern. The tabulation of particular types of outlets, wiring devices, or cable should be listed in the same column for all jobs.

Typically, the columns across the top of the branch circuit take-off may read:

1. Floor or area
2. Ceiling outlets
3. Bracket outlets
4. Device outlets
5. Special outlets
6. Plug receptacles
7. S. P. Switch
8. 3 w switch
9. 4 w switch
10. Special switch
11. Special receptacle
12. 2 No. 14
13. 3 No. 14
14. 4 No. 14
15. 2 No. 12
16. 3 No. 12
17. 4 No. 12

The precise order is not important; if printed forms are used it is set up by the printed column heads. But if a standard order is always used, it is an automatic check on the completeness of the take-off.

Example

The accompanying table illustrates a typical branch circuit take-off on a store job. The layout divided conveniently into four areas. Each area was handled separately and listed as A, B, C, and D. All runs were laid out with the number of wires indicated.

Ceiling outlets were counted, checked off and the number entered on the take-off. Bracket outlets were similarly counted and listed.

The next two items are derived from the count of wiring devices and fixtures. Here we find our first check point. The outlet total should equal the total of devices and fixtures.

The example has been simplified to eliminate combinations of devices. Some estimators prefer to ignore such combinations, such as two or three switches under one plate, in the take-off. When they occur frequently, however, it is advisable to give combinations separate headings. The difference in material cost of individual as against grouped devices is small, but most labor units place a relatively high value on the outlet.

One fixture in this project was a recessed type with the conduit terminating in the enclosure. This was noted as a special outlet. The fixtures were taken from a schedule but listed here to provide a check against the outlet totals.

The conduit and wire are taken off together, each type of run accumulated on the wheel separately. The wire and conduit are then sorted out of the totals as shown in the example.

In reading the wheel at $\frac{1}{8}$ scale, it is common practice to take 12 inches as equal to 100 feet. This allows for waste and unusable short nipples: Thus, in reading a wheel showing 2 feet 7 inches, the estimator enters 256 feet although the precise measurement would be 248 feet.

There are three customary ways of taking off vertical drops to switches on stubs up to receptacles. Most common is to overrun the outlet by the required amount. This takes experience and considerable skill. A more precise method uses a line drawn at the side of the plan with outlet elevations indicated. The wheel is run over the appropriate section of this line for each vertical run. Another method is to measure horizontal runs and calculate the vertical runs by the number of bracket outlets, plug receptacle outlets, etc. This method is cumbersome and subject to considerable error unless very carefully worked out.

A practical length of conductor must be provided at each outlet for connections, a minimum of 8 inches must be allowed with 12 inches the normal amount. Allowance must also be made for the panelboard hookup. Such allowances are usually calculated. There are an average of four conductors per outlet or between 3 and 4 feet required. In the example, 78 outlets (counting the panelboard as one outlet) allowing 4 feet per outlet would give 312 feet on almost exactly 15 percent of the measured amount. The outlet analysis and the percentage adder both have their adherents among estimators. The important point is that an allowance should be made for connections and, as can be noted from the example, it is a substantial percentage of

TYPICAL BRANCH CIRCUIT LISTING

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	Outlets					Devices									Circuit Wiring							
Area	C. O.	B. O.	D. O.	X. O.		P. R.	S. P.	3W	4W	XS	XR		FX		2-14	3-14	4-14	5-14	2-12	3-12	4-12	
A	16	1	7	1		1	6						18		41	60	15	11				
B	6	2	8			3	4	2					8		153	47	18					
C	7		9			6	3						7		127	44	12					
D	12	1	7			2	5						13		184	142						
T	41	4	31	1		12	18	2					46		485	293	45	11				
															x2	x3	x4	x5				
															970	879	180	55				

24 Wire	25 Conduit	
	½"	¾"
970		
879		
180	485	45
55	293	11
2084 ft.	778 ft.	56 ft.
312 15%		
2396 ft.		

NOTES:

Col. 1—Ceiling outlet—54171 with hanger & fix. stud.
2—Bracket outlet—54171 with 3 in. plaster cover and box support.
3—Device outlet—sw. box—3 in. deep and box support.
4—Flush fixture.
7-8-9—Devices specification grade with .06 chromium finish plates.
14—Fixtures as listed in fixture schedule.
16—Type T wire in galv. rigid conduit.

the branch circuit conductors on the average job.

Notes should be entered on the take-off sheet to make the headings clear. Exactly what is included in a ceiling outlet or other item should be shown. A good take-off sheet should be entirely clear to another estimator or a pricing clerk without further explanation, except reference to the specification or current stock sheets.

Where items deviate from conventional, it should be carefully noted. For example, under 7, 8, 9, the devices are specification grade, the plates are .06 chromium finish plates. Whether or not the estimate is to be priced by another, these notes are still a check on the estimator.

The steps in converting take-off measurements to useful values are evident from the listing shown. Circuits are listed by number of wires; 2, 3, 4 and 5 conductors. This take-off is translated into feet of wire at the total by appropriate multipliers. The conduit is similarly derived from the circuit wiring totals. In the example a maximum of 3 No. 14s is allowed in ½ inch conduit. Thus, the 2 and 3 wire runs are totalled for ½ inch and the 4 and 5 wire runs for ¾ inch. If the installation were made with cables, the wire allowance shown would have to be applied to the cable totals.

The example shown is typical of a relatively simple project. On larger work with a greater variety of outlets, the number of columns may be many more than those shown. More than one branch circuit take-off sheet will often be needed.

COMFORT CONTROL WITH UNIT

Ventilation, and cooling for comfort through unit package equipment. In the following pages we present an editorial review of a major market for electrical wiring and installation.

VENTILATING and air conditioning equipment will establish new records and new market frontiers this year, if the trends of recent years continue.

The portents are all toward more public interest in provisions for summer comfort. Equipment and cooling are available in many new and attractive forms. Much of the apparatus is in unit or package form, ruggedly built, finely engineered, trouble-free and easily installed.

In most applications, the installation of unit air control apparatus involves the mechanical work of locating and attaching to the building plus provision for electrical service and control, substantially the same in technique and scope as the installation of any other type of electrical apparatus.

Electrical contractors and service shops provide logical, effective and well equipped distributor, dealer and installation facilities for this rapidly growing industry.

Impact on Electrical Work

The impact of large new electrical loads for air conditioning is also a vitally important market consideration. Even the smallest room cooler will usually need a separate circuit and special circuit protection. Several coolers will affect the entire system design all the way back to the service entrance. Wiring systems, even those installed in recent years, are almost never designed to handle the substantial additional loads required by cooling equipment.

A major step toward summer comfort control can often be made by means of effective ventilation and circulation equipment. Trends here are toward heavy duty fans which can handle large air volumes and create sensible air motion over large areas.

While exhaust fan markets in some areas may seem fairly well worked over, a review of existing jobs in the light of modern standards of ventilation and comfort requirements will uncover much new business.

Supplying or removing air to or from any enclosed space by either natural or mechanical means is the sole objective of *ventilation*. This takes into consideration only air movement, or *quantity*, and results from the use of various types of fans or exhaust units.

When the control of air *quality* as well as quantity is desirable or necessary, we must go further and consider *air conditioning*, obtained by simultaneously controlling several factors affecting the physical and chemical conditions of the atmosphere which, in turn, has a definite bearing upon human health and comfort.

True air conditioning *must* control temperature, humidity and motion, and *may* control the additional factors of air distribution, and the removal of dust, bacteria and toxic gasses from the atmosphere. This is stated in the American Society of Heating & Ventilating Engineers' Code of Minimum Requirements, for Comfort Air Conditioning is explained as "the process of maintaining within required limits the temperature, moisture content, movement and quality of air in enclosed spaces intended for human occupancy. If an installation cannot perform *all* of these functions, it shall be designated *only* by the function or functions performed."

In addition to comfort, air conditioning has several esthetic objectives, such as the *removal of odors* produced by physical organic reactions, tobacco smoke, cooking and certain industrial processes. *Cleaning* the air prior to circulation is another desirable objective, for dust and various pollens or chemical particles can be irritating to the mucous membrane of the nose and throat if present in high concentrations.

The human body has remarkable powers of adaptation to a narrow range of atmospheric conditions and, as skin temperature and body-tissue temperature rise, adaptive mechanisms come into being in the form of perspiration, controlled by nervous or chemical stimuli. However, when environmental temperatures rise to 95 or 100 degrees F, even excessive perspiration fails to dissipate the rate of heat production plus radiation and convection gains and the storage of heat results in increased body temperatures. In extreme cases, where body temperatures rise to 102 or 103 degrees, it is found that men work with decreased efficiency and are liable to heat exhaustion, or stroke. Even below these temperature limits, many experience dizziness or headaches, loss of appetite or nausea, fatigue or shortness of breath. Records prove that work in warm atmospheres requires greater effort and, as temperatures rise, production drops while accidents, disease and mortality rates increase.

Air conditioning, therefore, is becoming *essential* in many hot industries and is recognized as a very desirable factor contributing to comfort, efficiency, health and well-being in commerce and the home.

Effective Temperature

Sensations of warmth depend not only on dry-bulb temperatures but on air movement, moisture content and radiation effects. For example, dry air at a relatively high temperature may feel cooler than cooler air with a higher moisture content. The sensation of warmth, therefore, depends on the *effective* temperature, the resultant of temperature, humidity and air movement.

Conditions under which the average person feels comfortable have been charted on a comfort chart which indicates that summer comfort may be expected between the ranges of 68 degrees F (dry bulb) with 70 percent relative humidity, and 85 degrees F with 30 percent RH. This is translated as a range between 66 and 75 degress of *effective* temperature.

In designing and selecting air conditioning equipment, it is first necessary to know the probable cooling load to be placed on the unit or system. Load calculations depend upon numerous factors, including outside weather conditions, duration and type of occupancy, the relationship between wet- and dry-bulb temperatures, air motion,

solar radiation, the structural construction and design of the building, and the heat emission from motors, appliances or industrial processes within the structure. Geographical location is another factor.

Control of unit air conditioning systems may be automatic or two-position on-off. However, manufacturers are now generally recommending the continuous operation of the fan, with automatic regulation of cooling coils or compressors. Automatic control, in this case, is by a thermostat placed either in the intake duct or located at some typical point in the room being cooled. This method gives continuous circulation and, as temperatures rise, cold water cooling coils are opened by an automatic valve controller. In cases where the cooling unit consists of direct expansion coils, the automatic control either starts a compressor, opens a valve in the refrigeration line or closes a by-pass around the coils. When on-off operation is used, the cooling units are controlled by thermostats activating the operation of fan motors.

Factory-produced Units

Air conditioners, produced in factories, can be obtained to provide all of the services that can be obtained from a field assembly. The advantages of unit equipment, however, are most apparent when capacities are below 12000 cfm, for handling and assembly costs favor field assembly when units have refrigerating capacities larger than 40 tons.

In order to secure the economic advantages of mass production, manufacturers generally limit their production of air conditioning models to a relatively small number, each model covering a range of capacities. Performance, as a result, is a compromise between rated capacities and the actual cooling load of a room or structure but this is not objectionable for the cost of a unit slightly larger than normally required is relatively slight and the larger unit provides for extra capacity under abnormal conditions, and also minimizing the possibility of overloads.

Where close control and exact capacities are not critical, additional savings can be achieved in factory-assembled units by combining the air handling and condensing equipment in a single cabinet, balancing the capacities of coil and condenser. These combination units widen the compromise between actual load and rated capacity of the conditioners, but units of ½, 1½, 3, 5, 7½, 10 and 15 tons refrigeration capacity are proving economical in many homes, offices, stores and both small and medium-sized commercial and industrial plants.

As to component parts, factory cooling units consist of (1) airtight sheet-steel *casings* having removable panels for access to coil connections, blower bearings and other encased parts, (2) *insulation* for water-, vermin, sound- and heat-protection, (3) *drain pans* treated to resist the corrosive action of the mild acids absorbed by the condensate, (4) *blowers,* with oil cups conveniently located outside the casing to promote lubrication facility, (5) *cooling* and *dehumidifying coils, filters,* either of the throw-away or cleanable types, and (6) *motors,* usually located outside the unit to decrease the absorbed heat within the enclosure and to permit ready access for servicing.

Vibration dampeners of either felt, sponge or rubber-in-shear should be used to isolate and minimize the transmission of sound or motor motion.

Floor and beam loadings should be carefully checked before installing conditioners, for suspended units can add up to 100 lbs/sq. ft. and self-contained installations can go as high as 200 lbs/sq. ft. When floors are already heavily loaded or should the roof construction be for a minimum snow load, this extra strain could easily be the cause of excessive beam deflection, cracked plaster, the creation of fire passages or dropping the equipment. When units are located on ground floor levels, the placement of an extra column beneath it is an excellent precaution for both overloaded beams and transmitted vibration.

Wiring should be carefully checked, for few existing buildings are wired to carry the added load of even a small room cooler without affecting the voltage. Since this voltage drop will affect the life of the unit, due to slower starting, and will also cut output of the lighting circuits, a separate electrical circuit is not only desirable but necessary. This added circuit should be 12 gauge or larger, with flexible conduit used for motor connections to prevent sound transmission. To avoid confusion with light switches, control switches—either single or dual using a 3-way switch—should be located at least a foot above the customary height of light switches. And, when a constant check on operation is desired, the use of a pilot indicating light is recommended. One further recommendation is to install a quartz fuse link in the air intake duct, set to operate at 140 degress F, so linked that a cut-off switch in series with the fan motor will take the unit out of service in case of fire.

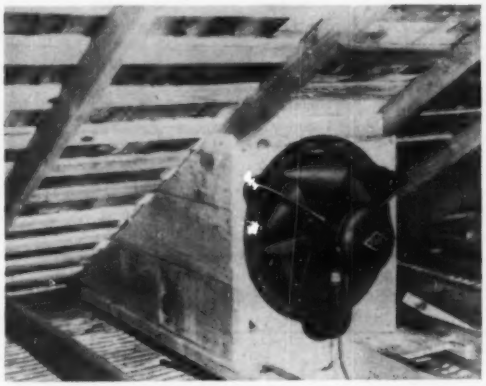
AIR CHANGE TABLE

CLASS OF BUILDING	*Recommended Air Change for Sensible Ventilation and Cooling	Recommended Air Change for Good Ventilation
Offices	2 minutes	5 minutes
Stores	2 minutes	5 minutes
Restaurant and Hotel Kitchens	1 minute	2 minutes
Factories (General Ventilation)	3 minutes	6 minutes
Garages	3 minutes	6 minutes
Halls (Meeting)	2 minutes	5 minutes
Churches	2 minutes	5 minutes
Theaters	2 minutes	5 minutes
Laundries	1 minute	3 minutes
Home Kitchens	1 minute	2 minutes
Attic Cooling and Ventilation	2 minutes on floor below attic space	.....
Farm Barns	.....	60 CFM per cow
Poultry Houses	.....	30 CFM per horse ½ to 1 CFM per chicken

* Sensible Ventilation and Cooling: Exhaust ventilation with a rate of air change sufficient to provide good ventilation, refreshing air movement, and effective heat exhaust.

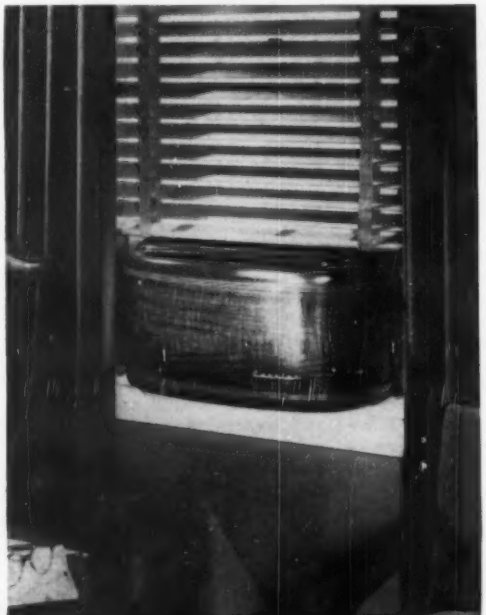
COMFORT CONTROL With Unit Equipment (continued)

Unit equipment is available in a wide range of types and sizes to meet many kinds of ventilation circulation on cooling problems. Here are a number of representative types.

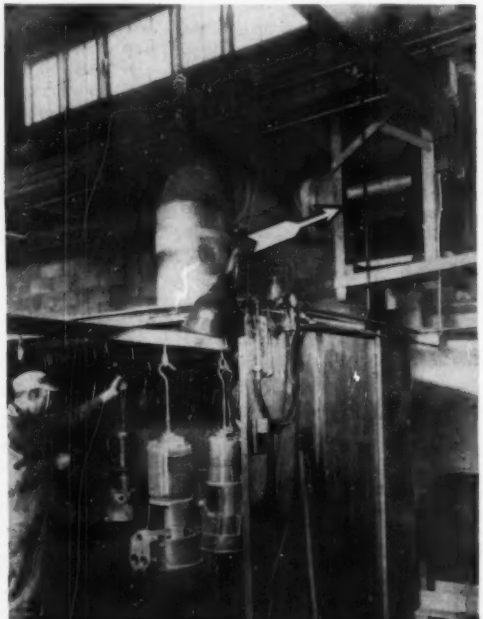


PROPELLER FAN *installed for night-cooling in the attic of a home. When turned on, the fan exhausts day-time heat.*

INSTALLATION *of packaged air conditioner. Unit illustrated has 24,100 Btu capacity; is designed for office application.*

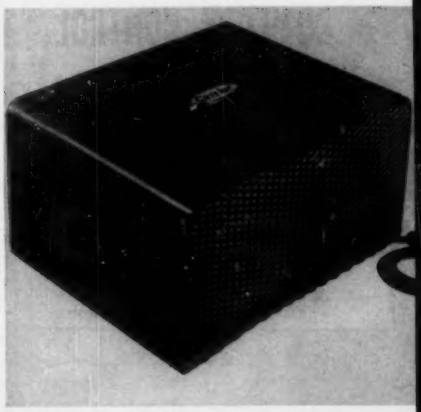


ROOM AIR CONDITIONER *for windowsill installation; available in a capacity range from one-half to one horsepower.*

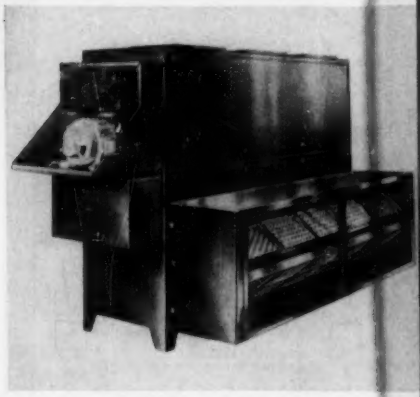


CENTRIFUGAL FAN *exhausting heavy fumes and odors from a paint spray booth in a manufacturing plant.*

FUMES AND ODORS *are quickly exhausted from this garage by the 36" motor propeller fan installed in a panel in the window.*

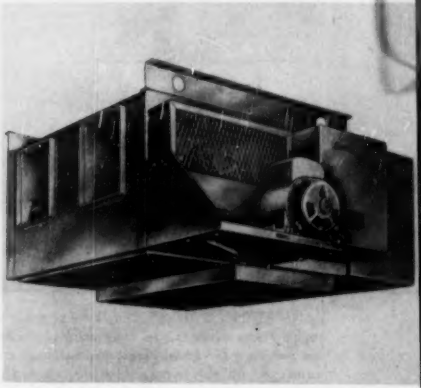


UNIT DESIGNED *to dehumidify the air in damp basements or other areas in which mildew forms to damage goods and fixtures. Widely used in bank vaults, tobacco plants, bee hives and storage spaces for clothing and wood products.*



INDUSTRIAL TYPE *air conditioner designed for floor mounting, discharge at top.*

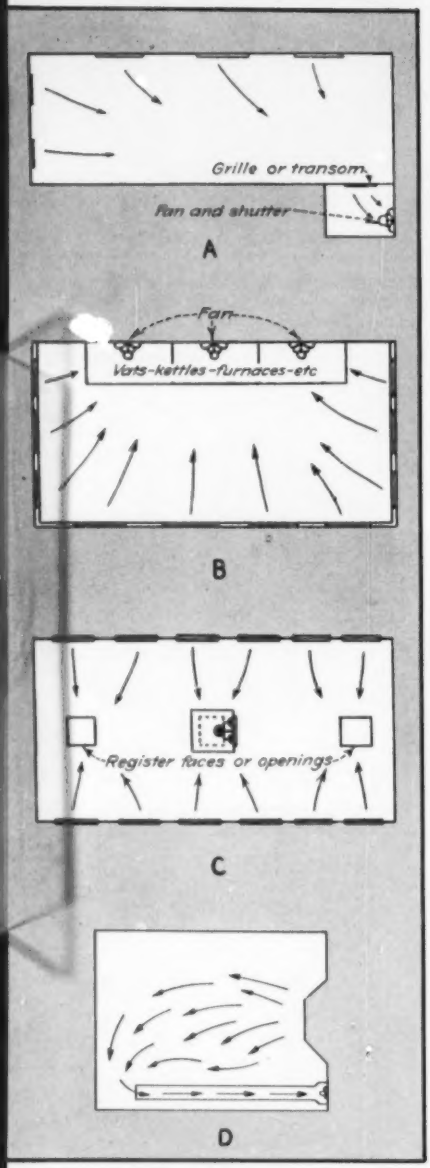
COMFORT COOLING *in country club locker room is provided by propeller fan installed in roof gable.*

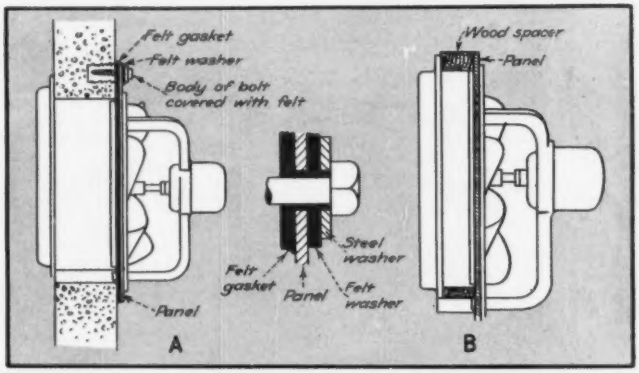


INDUSTRIAL TYPE *air conditioner designed for ceiling suspension.*

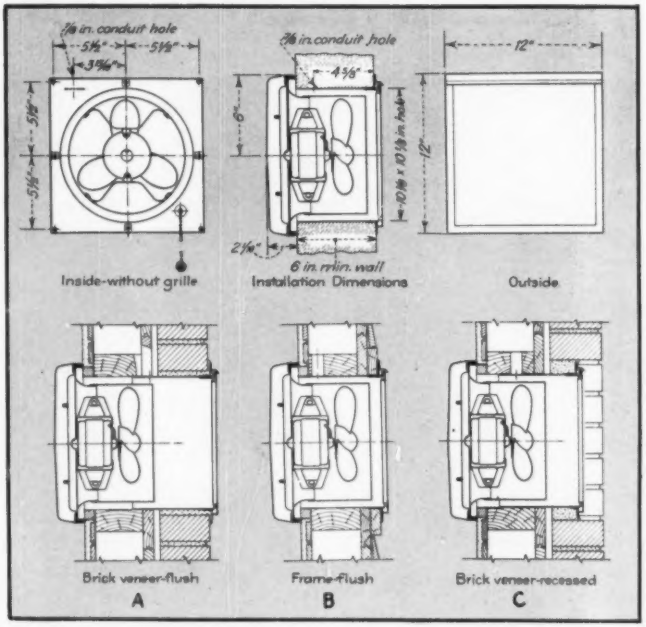
COMFORT CONTROL With Unit Equipment

Typical methods and details relating to installations.





ISOLATED MOUNTING *of fan to minimize noise by using felt gasket (A) or other resilient material between fan panel and wall and mounting bolts. Automatic shutter need not be "isolated." Wood spacers (B) are sometimes used when mounting fans to walls, in windows or skylights. Spacer should be 3½" or 4" wide material. Although wooden spacers and panels minimize noise, metal may be necessary in certain installations.*



FANS SHOULD BE PLACED *to provide air circulation across entire room or area. In industrial and commercial areas, units can be placed: A) in closet or small room to ventilate adjacent room; B) on the windowless outside wall of a room and over equipment which is polluting air; C) in a penthouse with short duct and hood or grilles in suspended ceiling to ventilate area below; D) at the front exterior wall of a "blind room".*

WALL INSTALLATION *of room ventilators in: A) brick veneer wall (flush); B) frame wall (flush); C) brick veneer wall (recessed). Where wall is thicker than fan wall box, line opening with No. 30 gage sheet metal sleeve. Units of this type can be used in kitchens, bedrooms, laundries, nurseries, recreation rooms; in private offices, conference, reception and small display rooms and other small areas.*

Ways to Lower Costs V

Continuing a series on practical ways to expedite maintenance.

Mass conduit bending is a bench job with power-operated bender. Mechanic can operate ram and measure offset at same time.

39. Power-Operated Conduit Benders

Power-operated conduit benders are taking the drudgery out of this chore and speeding up the job. One electrically-driven hydraulic pump cuts bending time by 67 percent; provides finger-tip control of bender; permits mass production of similar bends on table top; eliminates hand-pumping fatigue. Time study records indicated that a two-man crew (one on conduit, one on bender) on a large construction project made sixty duplicate offsets in 1½-inch conduits in a four-hour period. Union is portable and is being applied to hydraulic pipe pushers.

Complete maintenance of lighting system includes constant check on lamp depreciation, low voltage, improper fixture design or application, reflectance of wall and ceilings, lamp outages, dust and dirt.

40. Lighting

The importance of maintaining a good lighting system cannot be overstressed. It is a positive factor in safety, increased production, accuracy of workmanship and personnel morale. Economical lighting maintenance is essentially a problem of minimizing light losses, for lost light (paid for at the same rate per footcandle as useful light reaching work areas) represents lost dollars. Lost light results from lamp depreciation, low voltage, improper fixture design or selection, reflectance of walls and ceilings, lamp outages, dust and dirt. These factors suggest a close check on average lamp life, noting the hours of service, periodic relamping, regular cleaning of lamps and reflectors, frequent voltage checks and prompt replacement of faulty ballasts, starters and lamps.

RELAYS

Symptom	Trouble	Cause	Remedy
Circuit breaker does not open when load reaches point considerably above normal relay setting.	(a) Timing element defective	(a) Air vents closed too tightly	(a) Open air vent slightly, oil with neatsfoot oil
	(b) Plunger of plunger type relay jammed	(b) Heat from relay coil buckling the core in which the plunger moves, preventing it from moving	(b) Replace coil with new one
	(c) Disc of induction-type relay rubbing or out of place	(c) Disc jewel broken or out of place, owing to vibration	(c) Renew jewels
	(d) Grease or dirt on relay contacts	(d) Relay cover not dustproof contacts have received rough handling	(d) Remove all dust and dirt

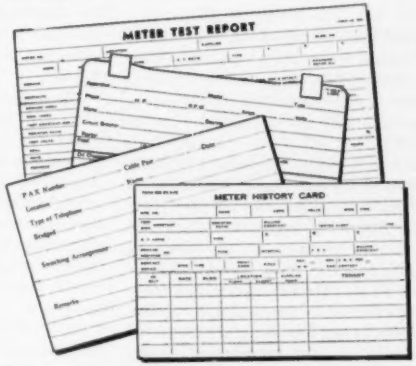
And so on . . . .

Analysis charts are excellent for trouble shooters for they not only list the defect and a possible solution but also include the causes behind the faulty operation of equipment.

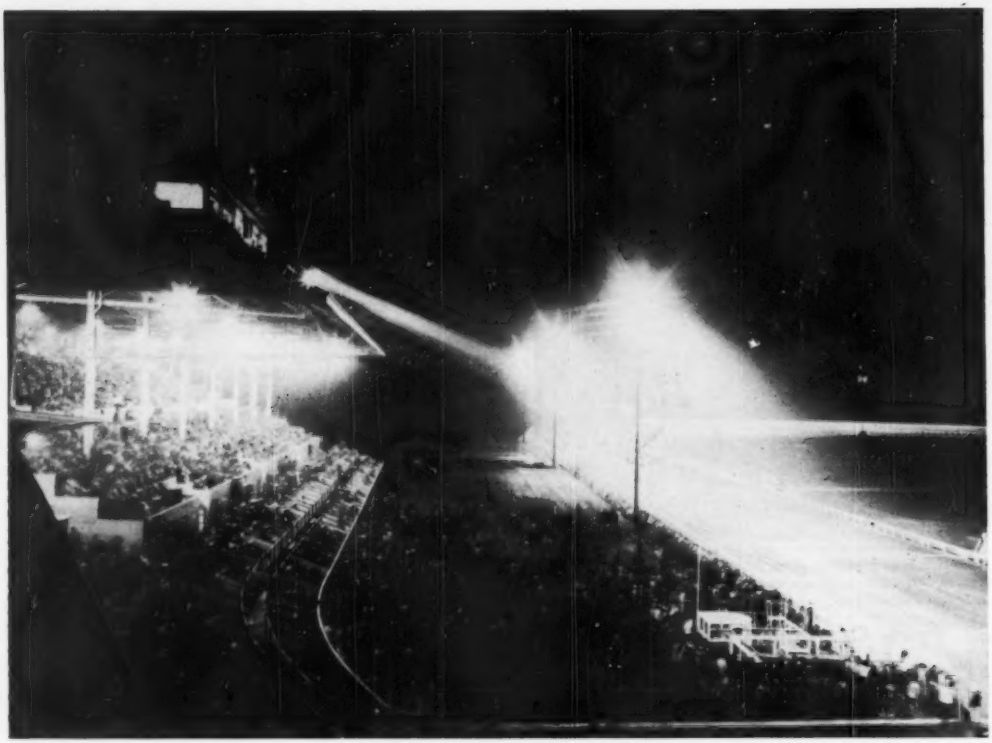
41. Analysis Chart

Of even greater value to trouble-shooting crews is an analysis chart. This is somewhat reminiscent of a medical diagnosis for it lists symptoms, trouble, cause and remedy. While still general in scope it has the advantage of suggesting a course of procedure for not only correcting an existent faulty condition, but also tracing the trouble *causing* the fault and correcting the *cause*. Above is part of an analysis Chart pertaining to relays.

42. Records



Records are cost-saving factors in any plant for finger-tip knowledge of motor data, test information, cost sheets, wiring plans and similar information is essential when checking, revamping or extending an electrical system.



PORTLAND MEADOWS, ***mile-long race track at Portland, Oregon, sets pace for night racing track lighting. Installation consists of 336 1500-watt G. E. Type L-69 enclosed floodlights in 19 banks, with lamps operated 10 percent overvoltage.***

Portland Meadows Sets Lighting Pace

By Berlon C. Cooper

PORTLAND Meadows, one of three major race tracks on the West Coast, has assumed new prominence. It has become the first mile long running track in the country to be lighted for night horse racing. It is also reported to be the most brilliantly lighted of all race tracks in the nation.

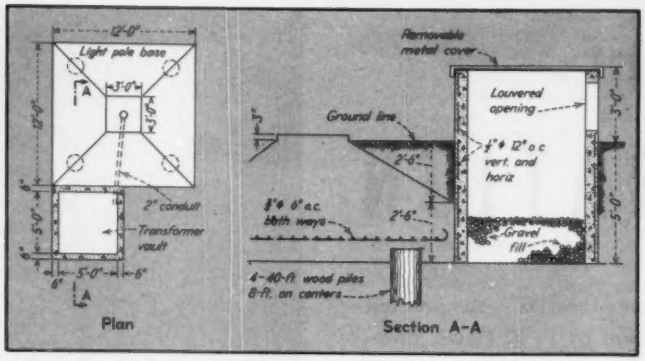
The lighting system for the Portland Meadows track comprises 336 floodlights grouped in 19 banks on floodlight poles which are each 80 feet high. Four banks in front of the grandstand contain 24 floodlights each. The five banks on the straight stretch of track opposite the grandstand contain 12 floodlights each. All other banks, located on the curved ends of the track, contain 18 floodlights each.

The General Electric sports floodlight, Type L-69, was used throughout. All floodlights were installed so that light is projected against the progress of the race. This method puts all shadows in back of or under the horses, and permits better viewing by the spectators.

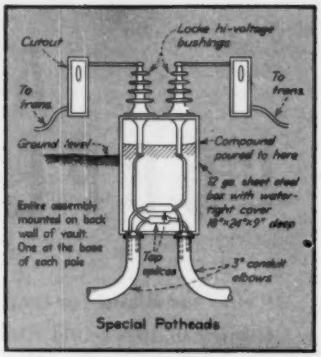
Each floodlight is equipped with a 1500 watt standard service PS-52 lamp, rated 110 and 115 volts, insofar as they were obtainable. Transformer taps are set to deliver a voltage at socket of 120 to 125 volts, averaging ten percent overvoltage. Total power consumed by the 336 floodlights is thus approximately 550 kw., taking into account the overvoltage. Operation of the lamps at 10% overvoltage increases the light output more than 30%, while decreasing the operating life of the lamps by about 40%. This is considered economical, in view of the relatively low cost of lamps as compared with power costs and initial cost of additional floodlights, poles, transformers and wiring capacity and installation costs which would otherwise be required to produce an equal amount of light, if lamps were operated at rated voltage.

The floodlights used are made of Alzak processed aluminum, with the impact-resisting front door glass spun-sealed into the reflector. The socket housing is removable for relamping and maintenance. A rifle sight attached to each floodlight makes easy the aiming of center of beam to area to be lighted by each unit.

Power for the floodlight units is supplied at 11,000 volts primary right to transformer vaults installed at the base of each floodlight pole. Service is overhead to the main vault in the clubhouse. Here a 3-pole oil circuit breaker, operated by a handle through the vault wall, controls the track lighting through a set of 11,000 volt buses.

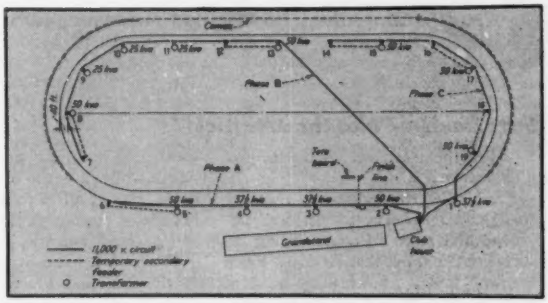


DETAILS OF CONSTRUCTION *of transformer vault and floodlight-pole base.*


Cutout
Locke hi-voltage bushings
To trans.
To trans.
Ground level
Compound poured to here
12 ga. sheet steel box with water-tight cover 18"x24"x9" deep
Entire assembly mounted on back wall of vault. One at the base of each pole
Tap splices
3" conduit elbows
Special Potheads

DETAILS *of special potheads.*

EACH FLOODLIGHT POLE *is anchored to 12-foot square concrete base, supported on four 40-foot wood piles. Adjacent to each pole is transformer vault.*



RACE TRACK PLAN, *showing distribution of electrical power at 11,000 volts single phase to individual transformers located at base of each floodlight pole.*

Portland, Oregon, mile-long race track installs 550 kw. lighting system, making it the nation's brightest lighted raceway.

Power from these buses is delivered to the floodlighting load through three single phase circuits, each of which carries approximately one-third of the load. Each circuit is run underground through two No. 2 single conductor, 15,000-volt varnished cambric and lead covered parkway cables, direct earth burial type.

A transformer vault five feet square and eight feet deep, projecting three feet above grade level, is located adjacent to the base of each floodlight pole. The bottom of each vault is filled with gravel to raise the transformers so that all high voltage leads are above ground level. Potheads were installed on the back wall of the vault with a 7200/12500-volt cutout on each side.

The 80-foot high floodlight poles are set on concrete bases twelve feet square containing 22 cubic yards of concrete each. This base is set on four 40-foot wood piles, made necessary due to the fact that the location is filled with silt washed in from the river.

Secondary current from individual transformers at each floodlight pole location is run in conduit through the pole base and into the pole; then up to a fuse panel at the top of the pole, where each floodlight is individually fused.

Materials shortages also made it impossible to obtain transformers of proper rating for use at each floodlight pole. This problem was solved by using transformers which were available, and installing temporary secondary feeders at some of the locations. Final installation, when properly rated transformers are available, will consist of five 37½-kva, and 14 25-kva transformers, one at the base of each floodlight pole.

The entire electrical installation at Portland Meadows totals more than 1000 kw. In addition to the 550 kw track lighting load, 80 kw is used for floodlighting in parking areas, 300 kw for lighting, cooking, etc. in the grandstand and clubhouse, and 100 kw for lighting and power in the cafeteria and stable area. Primary service at 11,000 volts is fed into the project and metered at two separate points to handle this entire load. One service goes to the main vault in the clubhouse, while the other goes direct to the stable area. Four 75-kva. transformers in the main vault supply power for the grandstand and clubhouse lighting and cooking.

Electrical engineer for the Portland Meadows project was Wally Matson of Portland. General Electric lighting specialists cooperated in the design and layout of the track lighting. The Tice Electric Company, Portland electrical contractors, handled all electrical construction and installation on the project.

A-W COOPERATION

"Who's to Blame for Contractor Inertia" is the pointed subject of this panel discussion by F. E. Davis, Commonwealth Services, Inc., of Jackson, Michigan, and H. L. Scott, Scott Electric Company of Corpus Christi, Texas, at the Adequate Wiring Conference in St. Louis.

F. E. DAVIS

Says Davis—"Not the Utilities!"

"Does the electrical contractor exhibit inertia?

From the standpoint of resisting change, and efforts to perform improved and more adequate wiring installations, I think that he does. From the standpoint of working hard at what he does to make a living, nothing could be farther from the truth.

I am willing to bet that a little sales effort with the customers toward the end of selling and installing the kind of wiring jobs we all know are really required today would produce a reputation that would not only result in more and better jobs, but a fairer profit as well.

Electrical contractors are notoriously reputed to be the world's poorest salesmen or no salesmen at all. They would rather rely on Code and ordinance requirements enforced by law for minimum installations and then put in the minimum jobs because in these circumstances all the contractors have to quote on the same thing, with perhaps some minor chiseling here and there. Practically all chance of doing a good job is blocked before it is begun. Then, in a number of locations with which I am familiar, much contractor support is given to the promotion of ordinance requirements for what I call "gold plated" wiring in which expensive components are required to be installed rather than the expanded amount of wiring that could be installed at the same or slightly higher overall cost if more reasonable methods were utilized.

The contractor alone can help in eliminating the unessential requirements and in selling the desirable and worth-while aspects of modern adequate wiring, all of course, within the bounds of reasonable safety from fires and personal hazards.

We have a national safety standard in the National Electrical Code and while it may not be perfect and by no means may be considered an adequacy standard, experience has shown it to be very difficult to improve as a safety code except as technological improvements take place as time goes on. Local special rules are the bane of the wiring industry and have very seldom, indeed, proved to be of benefit even in local areas. If the Code is deficient, such deficiency may be readily rectified through a most proper and acceptable procedure that provides the required "checks and balances" for all interests. It is the American Standard for Wiring. Let's support it.

One of the greatest complaints I hear regarding electrical contractors is that they try to get prices for a job in accordance with usual specifications, which incidentally are nearly always inadequate, and then try to increase profits by cutting every corner they possibly can. This doesn't help the industry or the contractor.

Another factor for which perhaps the contractor cannot be wholly blamed, is that the specifications given him for quotations are often obsolete and no opportunity for suggestions for improvement is given or such suggestions may not even be tolerated. Here, I blame the architects primarily and their general ignorance of electrical matters and their unwillingness to seek competent advice.

The whole industry has an enormous and most difficult job to do in domestic electric wiring. I believe that it can only be accomplished by education of those in the industry dealing with the various phases of wiring and sales. We first must learn the requirements, not oppose progress or wait until it is thrust upon us, and then we must develop and learn the know-how of adequate and economical installation for which the customer can pay and can be persuaded to spend his money.

We must quit trying, through unsafe practices, to make the present overloaded wiring carry more and more load until finally economic loss forces legal requirements for rewiring. That can only contribute in fire loss of free enterprise."

Says Scott, "Not Who But What!"

"In comparison with all of the other branches of the construction industry, the Electrical Industry is just a pup. It is quite possible that the carpenter blamed the lumberman and he blamed the logger for their confusion, if they had any confusion at the time when they were no older than we are. It is quite possible that the plumber blamed the gas works and the water works and the pipe mills and the foundries and enameling plants for his troubles years ago. But they are all pretty adequate in their own fields right now. I

H. L. SCOTT

am talking about manufacturers, utilities, wholesalers, distributors and everybody else who in any way makes their living out of the Electrical Industry. Let us say that if the contractor has Inertia, much of it is on account of the effect of unbalanced external forces.

So there is no wonder the contractor is bewildered and belligerent, and maybe the complacence of the others and their smug sureness of the futility of ever convincing the contractor that he should be the principal contact between the Industry and the Customer, and influencing him to function as such, are those external forces that are trying to move the body in various directions or to slow it down to a grinding halt.

If manufacturers, utilities and wholesalers would consider the contractor as an integral part of the ultimate end of delivering more and more kilowatts to the customer instead of just a necessary evil in the channel of distribution, the time would come when the contractor would fill that place in the picture as the principal contact with the customer, and the electrical industry would be a far stride ahead of its present position.

Too many contractors still operate their business as though they were still electricians and nothing more. I recognize these facts and I deplore them, but I also recognize the possibility that the contractor will never be able to pull himself up alone "by his bootstraps". Those contractors who are members of NECA are doing better than the non-members in the job, but I can also recognize the fact that many NECA members are just beginning to realize that the war is over. NECA members had the personnel, the equipment, the key manpower and the know-how to do the job of installation for the vast war production program that all Americans are so proud of. They did that job and they did it well.

But in the doing many of them got delusions of grandeur. They just couldn't be bothered with a paltry ten thousand dollar job, and the mere mention of residential wiring, unless it was a major housing project, was almost an insult. Those men are leaders in the contracting industry and they could be the leaders in a program of training and education to bring the contracting industry out of the status of electricians and into being first of all Business Men, if they will and I know that many of them are willing.

Let's look at another factor which contributes to this so-called inertia on the part of the contractors. If contractors, as a class, were only engaged in residential wiring—I mean, if residential wiring were the only field in which the contractor was allowed to engage—then the Electrical Contractor could concentrate on residential adequacy but would always be pretty small so far as the electrical field is concerned. Suppose by some wild flight of fancy, laws were to be passed making all industrial, commercial, school, hospital and public work a "labor-only" proposition. The contractor would then be in the position it seems many of the manufacturers and suppliers are trying hard every day to place him by their policy of selling direct to all of that market I have just mentioned without sufficient differential between the price to consumer and the price to the contractor, so that the contractor can successfully secure the business and complete it at a profit.

How can we overcome Inertia when so many opposing forces are working against us to keep us small? That is why so many of us have very small or no sales organization at all.

Every contractor has had the experience of having to content himself with half the electrical volume on many installations simply because a manufacturer or supplier in their frenzy to take business away from their competitors have gone directly to the school board or the chief engineer at the plant or the executive of the department store and sold the goods.

The utilities went out to build load. It was obvious that even short-range public relations would dictate that it woud be to the utilities' advantage to have enough copper in the installation so that lights would not dim when a small appliance motor started (the customer would blame the utility for the defect), and it was to the utilities' interest to have enough outlets so that the housewife would not be continually harrassed by "the inconvenience of electricity". So far, so good.

But the utility set out to achieve these laudable goals without, in virtually every case, any consideration for the man, who, first, was the one who could assure adequacy; and, second, who could be a goodwill ambassador for the utility. I mean the electrical contractor.

The utilities wanted all of these things done but they wanted them done at the very lowest price that could be rustled up. They wanted to create the impression with the public that electricity was cheap. And they blithely sacrificed the economic foundation of the branch of the industry that could do this job adequately, the electrical contractor.

The bushes were beaten for electricians and others who would install circuits and outlets. Inevitably the work drifted to the man with the lowest price. It made no difference that the man with the lowest price in many cases did not have the slightest idea of his costs. It made no difference that in order to come out he had to work at night, donating his services of management with a cut-rate value on his own labor.

You may say that the contractor tears down the installation. I hear that indictment particularly from wholesalers. I say that it is the wholesaler that, wittingly or unwittingly, is the one who in the last analysis is tearing down the electrical installation. When the competitive chips go down, it is a favorite practice of the wholesaler, or the manufacturer, who fears that he will lose the business to do one of two things: One, proposition the buyer to buy it directly and "save the contractor's profit", or, two, finance some unstable contractor who would enter a low bid and take a chance on an inaccurate estimate and bill of material concocted by the supplier.

This is the sort of thing that stops the progressive and ethical contractor who has the desire and the ability to do creative selling. This is the reason that with a few notable exceptions you find the qualified electrical con-

(*Continued on page* 158)

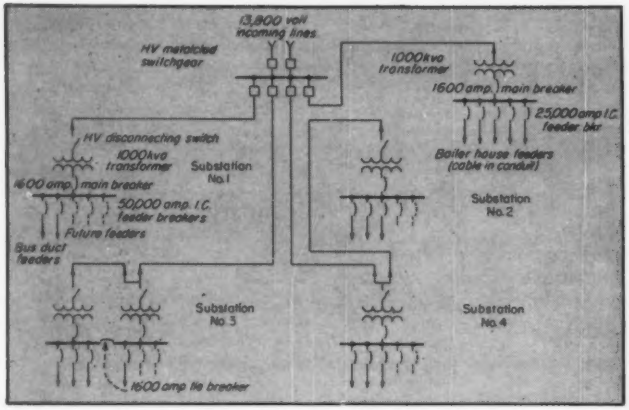


FIG. 1—*Power Distribution system includes high voltage switchgear and feeders which supply power centers installed in factory load areas.*

FIG. 4—*Typical power center comprising 1000 kva. air-cooled transformer and low voltage metal enclosed drawout switchgear.*

FIG. 2—*Assembly lines at GMC plant, Framingham, Massachusetts, are lighted by fluorescent industrial reflectors, and served by "hy-cycle" power through trolley duct for tools.*

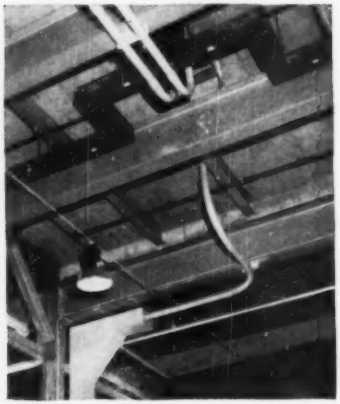


FIG. 5—*Incoming 13.2 kv. feeder runs to bottom of power center on floor above through Transite lined pull box.*

FIG. 3—*Main high voltage metal clad switchgear is located in boiler house, and is completely enclosed.*

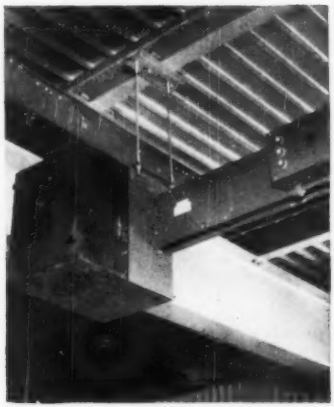


FIG. 6—*Feeder bus supplies plug-in bus through low voltage air circuit breaker.*

MODERN POWER DISTRIBUTION

J. Livingston and Company, electrical contractors, install modern electric power distribution system in General Motors automobile assembly plant at Framingham.

By Harry B. Thacker
Distribution Engineer
Westinghouse Electric Corporation
East Pittsburgh, Penna.

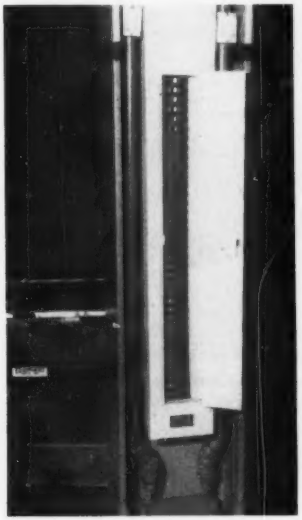


FIG. 7—*Circuit breaker lighting panelboard containing 36 circuits is column mounted.*

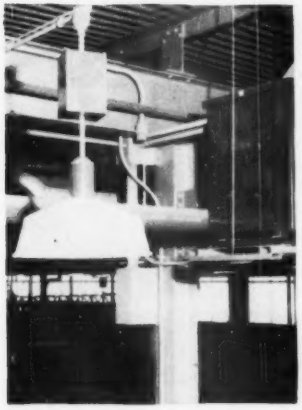


FIG. 8—*General illumination is by 400 watt mercury vapor units.*

THE terminus of automobile production is in the mechanized and highly coordinated lines of the modern assembly plant such as the Framingham, Mass. plant of the General Motors Corporation. The design of this plant, by Albert Kahn Associated Architects and Engineers of Detroit and the electrical construction and installation, by J. Livingston and Company of New York, have resulted in a typical example of present day industrial electric power distribution. Modern equipment for the distribution of power to the many electrically operated devices found in such a plant, has become a consideration of major importance in securing the results of carefully engineered production.

The physical layout of the Framingham Assembly Plant consists of a single large manufacturing building, one story with a partial second story penthouse. Integral with the front of this main building is a two-story personnel building containing offices, cafeteria, hospital and garage and forming the main entrance to the plant. The manufacturing building contains approximately 1,090,000 square feet of floor area including the penthouse area. Adjacent to the main building are several smaller buildings, the acetylene and service buildings and the boiler house.

Power is supplied to the plant over two incoming three phase utility circuits operated at 13,800 volts. These overhead open wire feeders are taken underground at terminal poles in the vicinity of the boiler house and run the remainder of the distance to the main high voltage switching point as single conductor cable in underground duct. The main high voltage metal clad switchgear (Fig. 3) is located in the boiler house. This modern, completely enclosed, unit structure is made up of eight sections: two for the 15 kv 600 ampere incoming line oil circuit breakers; four containing similar oil circuit breakers; and one for each of the four individual 13.8 kv plant primary feeders. Two other sections are used, one housing the power company's metering transformers and auxiliaries, the other containing a device for grounding or phasing out the incoming circuit on the bus.

Located in the same rooms as the 13.8 kv switchgear is the 60 cell, 120 volt storage battery and charger (Fig. 12), that is used to furnish dc power for tripping or closing the incoming line or feeder circuit breakers.

The general plan of distribution within the plant is based on the modern concept of carrying power to the centers of electrical load at a voltage considerably higher than the plant utilization voltage (Fig. 1). At each load center this primary voltage is stepped down to the utilization voltage through a relatively small transformer which, together with the necessary low voltage switchgear, supplies power to the loads in that particular area. The combination of three phase, air cooled transformer and low voltage metal clad switchgear, forming a coordinated, factory built power center (Fig. 4), is representative of the trend in modern industrial distribution equipment.

By carrying power throughout the plant at 13.8 kv a savings of six to seven times in cost of circuit copper is effected in these relatively long distribution circuits as compared to older types of systems in which power is distributed at the lower, or utilization voltage. In addition, losses in the system are reduced and the smaller voltage drops in the higher voltage circuits result in considerably better voltage regulation conditions at the loads. By using several smaller units of transformer capacity rather than one large main step down substation, the investment in low voltage switchgear is reduced, due to eliminating the large main voltage breakers required with the single substation.

In the Framingham assembly plant five power centers are used to step down from 13.8 kv to 480 volts three phase delta. Four of these power centers are located in the second story penthouse area of the main building, the other one is installed in the boiler house room containing the high voltage switchgear. Four of these five

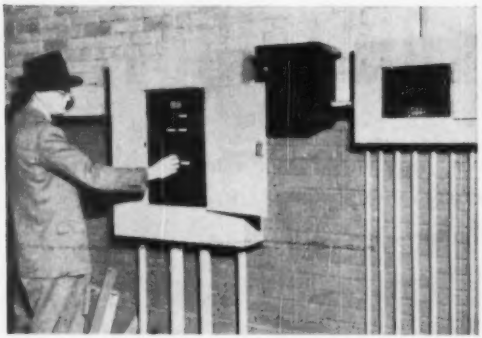


FIG. 9—*Panelboard at left is for power. Dry type single phase 480-120/240 volt transformer on wall supplies lighting.*

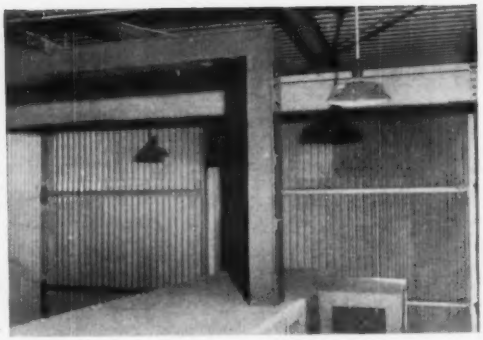


FIG. 10—*Feeder bus duct out of top of double-ended power center supplies load in penthouse area.*

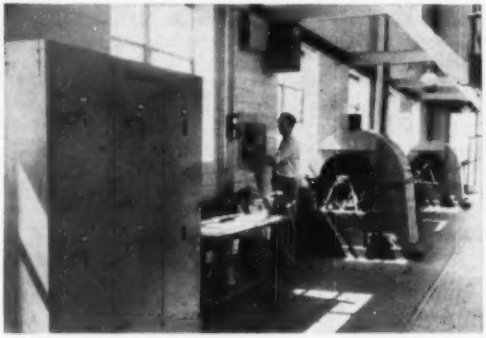


FIG. 11—*Unit type motor control center with combination starters control the two forced draft fans at right.*

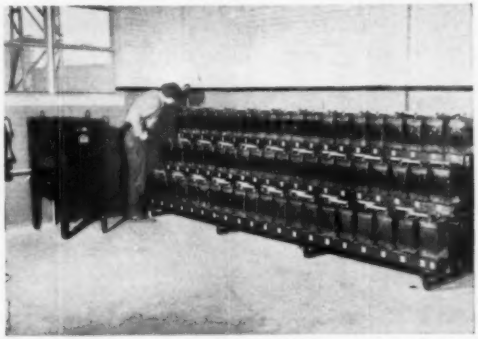


FIG. 12—*A sixty-cell battery with Rectox copper oxide charger is used to operate the high voltage switchgear.*

secondary substations consist of a single air cooled, 1,000 kva three phase, 13,800/480 volt transformer with high voltage disconnecting switch and cable entrance compartment, together with main secondary breaker and several low voltage feeder breakers. All low voltage breakers are three pole, metal enclosed, drawout type, 600 volt air circuit breakers, having an interrupting rating of 50,000 amperes. Substation No. 3, located in the penthouse of the main building (Fig. 10), is a double ended unit using two 1000 kva transformers, low voltage main and feeder breakers and with a normally open manually operated bus tie breaker which makes it possible to supply all feeders from one transformer with the other out of service. Both transformers in this double ended substation are supplied by the same 13.8 kv primary feeder. However, each transformer has its own primary disconnecting switch so that one or the other of the two can be shut down for maintenance purposes or during light load periods.

Three primary circuits supply the four main-building substations. These circuits are 15 kv, 3 conductor 4/0 varnished cambric, lead covered cable and are carried underground in concrete encased duct lines to the vicinity of the substation which they supply. Four-inch steel conduit risers bring the primary cable up to the penthouse substation locations. The risers are encased in concrete to the top of the vertical supporting columns, where a Transite-lined pull-box is installed (Fig. 5). Exposed steel conduit is run from the pull box up into the power center high voltage switch compartment where the cable is terminated in a three conductor pothead.

Secondary distribution at 480 volts is by means of three phase, metal enclosed, feeder and plug-in type bus duct. Two 1350 amp. main feeder bus duct circuits drop down from underneath the low voltage switchgear compartments (Fig. 5) in each of the four main building power centers. These overhead main feeders are run parallel to the front of the building, one in either direction. In addition to these runs of feeder duct out the bottom of each power center, two of the four main building power centers each have a third bus duct feeder taken out the top of the switchgear compartment (Fig. 10) and run overhead in the penthouse area. Perpendicular to the feeder duct which supplies the first floor and spaced about every 50 feet are 21 parallel runs of plug-in type bus duct. The feed point to each run of plug-in duct is located at the point of crossing with a main feeder duct and each plug-in duct is connected through a 600 volt air circuit breaker (Fig. 6). A similar arrangement of feeder duct, low voltage breakers and three parallel plug in duct runs is used to supply all loads in the second floor penthouse area. All 440 volt loads are supplied directly from the bus duct through fused safety switch plug-in units and conduit and wire. The flexibility and reliability of bus duct have resulted in a wide application of this general pattern of secondary distribution in many plants constructed or modernized during or since the war.

Lighting in the main plant building is by a combination of high intensity mercury and industrial type fluorescent units. Mercury units of 400 watt high

(*Continued on page* 159)

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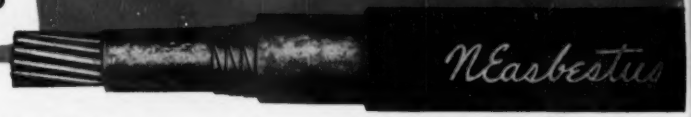

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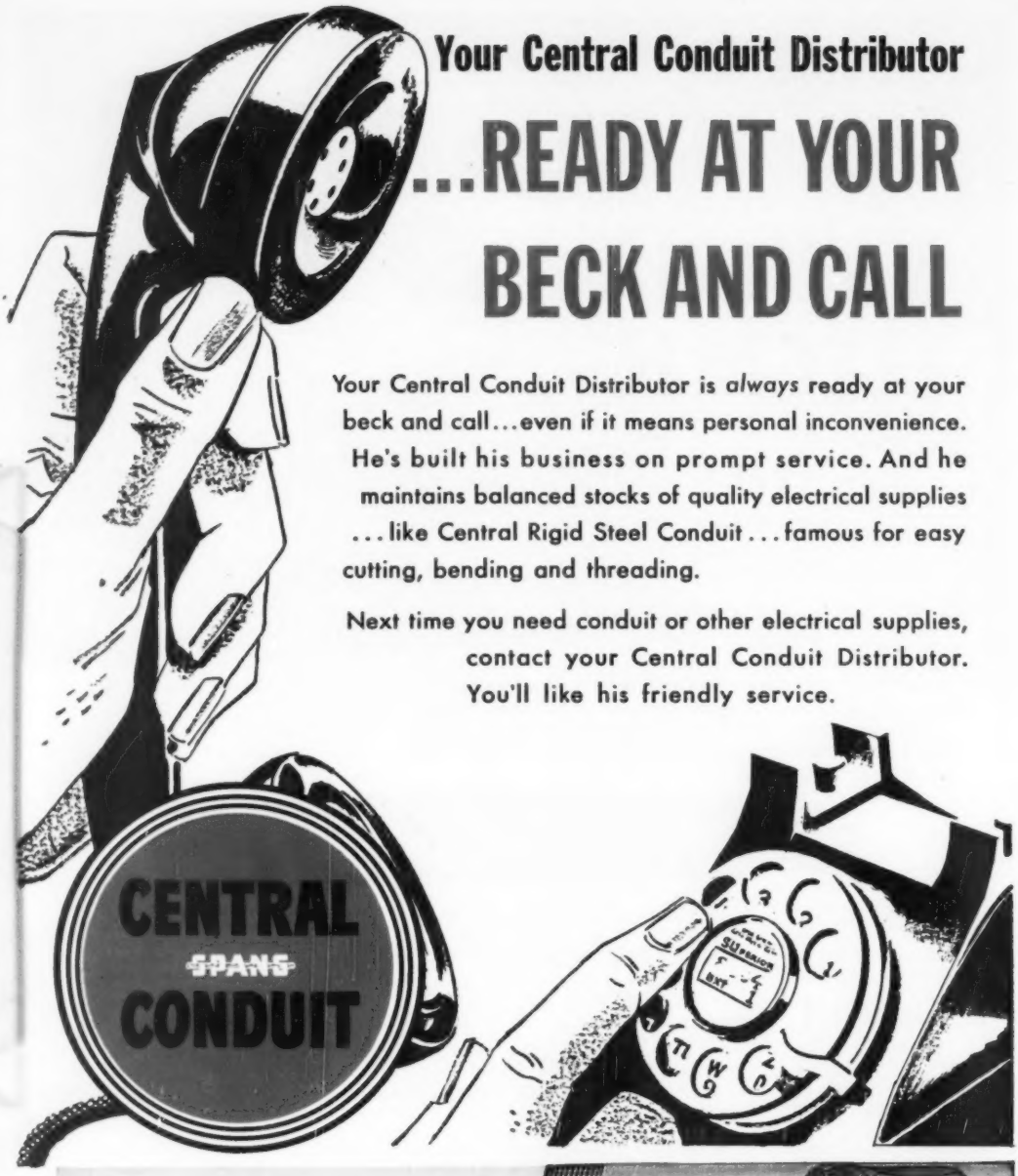

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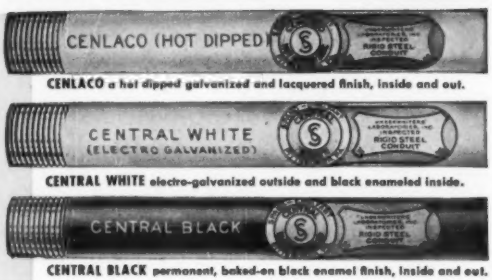

CENLACO *a hot dipped galvanized and lacquered finish, inside and out.*

CENTRAL WHITE *electro-galvanized outside and black enameled inside.*

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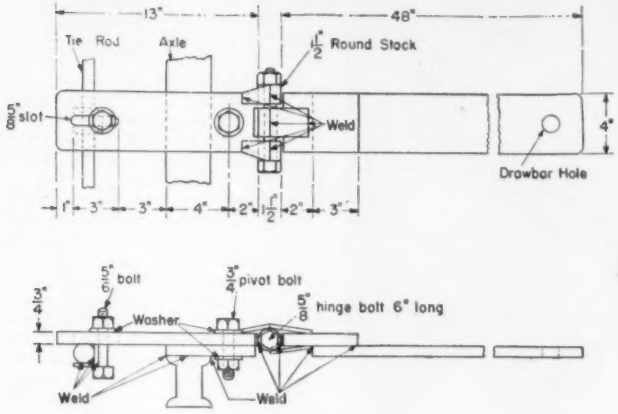
Practical Methods



STEERING HITCH *of welded construction, is used to connect trailer to rear of passenger car, providing facilities for hauling tools, material and equipment to construction or installation points.*

Trailer Hitch Welded From Scrap

WIRING

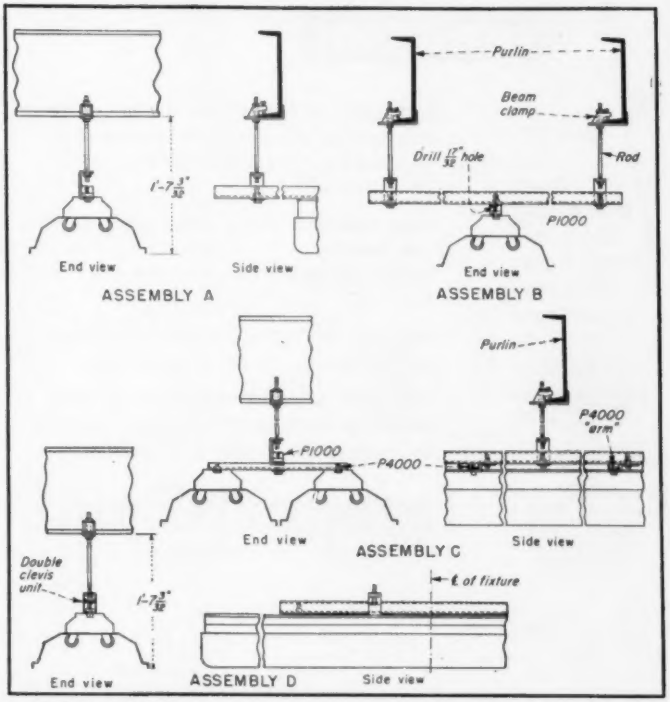
Utility trailers, carrying tools, material and equipment, can be hitched behind any make of passenger automobile by employing a steering hitch similar to one made from pieces of scrap metal by one of G.E.'s Schenectady employees. As diagrammed, the hitch will coincide with Buick dimensions but slight changes will make it applicable to any other make of car. Light and medium loads can safely be hauled by utilizing a steering tongue constructed from ¾- by 4-inch bar stock, as shown. However, if heavy loads are to be carried, it would be more practical to use a section of channel steel in place of the bar. The assembly is efficient and, with welded construction, it is sturdy.

Rigid Hangers for Fluorescent Units

WIRING

Fluorescent fixtures, because of their length and weight, require substantial supporting members. Actual mounting and installation techniques will vary with the type of fixture, type of installation, and structural conditions encountered. In industrial applications, fixtures are normally mounted direct to or suspended from the roof truss or purlin members. Individual suspension or continuous supporting means may be employed, depending upon the specific lighting layout. For continuous row systems, some type of angle-iron or steel channel or even messenger cable may be used. In all cases, rigid support is the prime factor under consideration.

This was the case in a Chicago area industrial plant where the electrical system was designed by Ralph H. Decker, Chicago consulting engineer. General lighting design in the manufacturing area called for the use of groups of industrial fluorescent units forming semi-continuous rows at right angles to roof purlins. Dual units (side by side) in rows of five fixtures end-to-end comprised a typical group. Two or three such groups formed the semi-continuous rows. In some areas groups of single fixtures, end-to-end, were specified.



DESIGN DETAILS *of fluorescent hanger assemblies fashioned from Unistrut channel and accessories. Assembly (A) is for individual fixtures at right angles to roof purlins; (B) for similar units parallel to purlins; (C) for dual fixtures in semi-continuous rows at right angles to purlins; and (D) for continuous row single fixtures at right angles to purlins.*

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To materially reduce installation time, facilitate alignment of units, and provide for salvability in case of future rearrangement of fixtures, Decker designed a system of Unistrut fixture assemblies to support the lighting system. The use of Unistrut beam clamps, channel, and other accessories eliminated all punching or drilling of structural steel and hangers and materially reduced layout and alignment manhours for the complete lighting system.

The main support for the dual fixture assembly consists of a P1000 channel suspended from the roof purlins by beam clamp and rod hangers. Fixtures are mounted to the ends of P4000 "arms" or brackets mounted, by angle clips, at right angles to the main channel (See Detail C). A long thread at the bottom of the suspension rod facilitates leveling of the fixtures.

In one ramp area where the fixtures were centered between and parallel to the roof purlins, a Unistrut trapeze hanger with beam clamp rod suspension was used. The fixture was mounted to the center of the trapeze bar (Detail B).

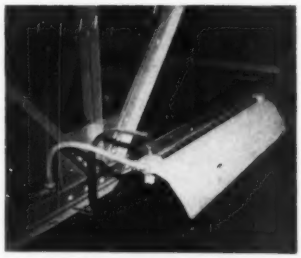
Beam clamp rod suspension of P1000 channel was also specified for installation of single fixtures either individually or in continuous row pattern. The only difference in the hanger assembly was in the suspension device for the channel. A double-clevis assembly (Detail D) was used for continuous mounting in place of the "C" bracket used for individual units.

In all cases, the fixtures were mounted to the underside (open slot) of the Unistrut members. Installation was made by Bowers & Clark, Chicago electrical contractors on the project.

Clamp-on Brackets for Truss-mounted Fixtures

WIRING

To suspend fixtures from roof trusses and still keep the bottom of each unit above the bottom truss chord, ALCOA engineers designed special



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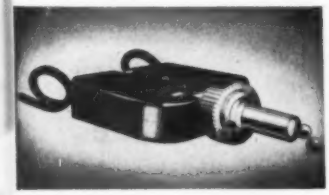
The small, compact size of the Model 41 makes it ideal for use in modern lighting fixtures and canopies, as well as for FHP motor control.



A new addition to the Levolier line is the Model 71. This 6 amp. 125 volt, "T" rated switch is encased in a molded plastic case less than ½" thick. Pressure connected six inch wire leads provide fast, easy installation.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

For New Catalog No. 49 Write: McGill Manufacturing Co. Inc., 450 No. Campbell St., Valparaiso, Ind.

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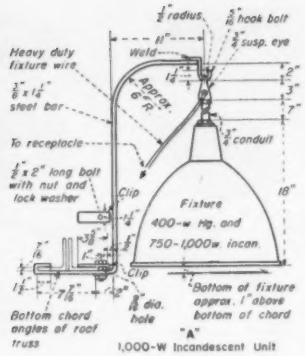
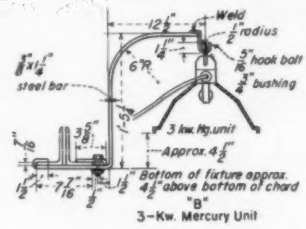
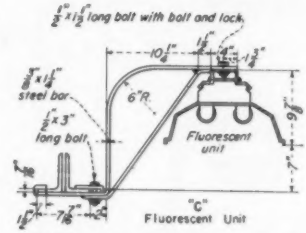
TRADE MARK
electrical specialties

ONLY McGILL MAKES Levolier SWITCHES







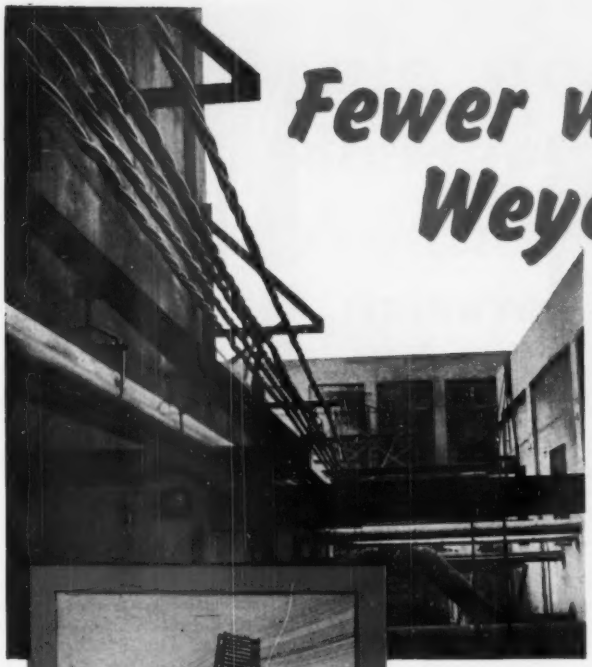
CLAMP-ON BRACKET ***details showing designs for: (A) 400-watt mercury and high wattage incandescent units; (B) 3-kw. mercury fixtures; and (C) fluorescent units. Hook support provides quick maintenance and replacement feature.***

brackets that clamp to the bottom chord angles of the roof trusses. More than 5,300 brackets of three types (two of them quite similar in design) were designed and built to supend 400-watt mercury, 750 and 1,000-watt incandescent, 3-kw. mercury, and fluorescent fixtures in high bay areas at the new ALCOA mill near Davenport, Iowa.

All brackets were made of ⅜-in. by 1¼-in. steel bar bent into an inverted-L shape (6 in. radius) and equipped with a 9$\frac{7}{16}$-in. clamp that fits over the bottom chord angles of the trusses. A clip with adjustable locking bolt holds each bracket firmly in place.

Brackets for the 400-watt mercury and the incandescent units are 31 inches high, extend 13 inches out from the chord angle, and are equipped with a ⅝-inch hook bolt to suspend the fixtures. Heavy duty flexible cords connect the fixtures to receptacle outlets

Fewer wires for Weyerhaeuser!



. . . space saved
. . . installation cost lowered
. . . all-weather dependability assured with

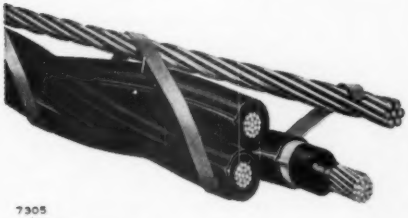
OKOLITE-OKOPRENE SELF-SUPPORTING AERIAL CABLE

At Longview, Wash., the new MgO sulphite recovery and new sulphate pulp processing plants of the Weyerhaeuser Timber Company typify the advantages of self-supporting cable in industry for the transmission and distribution of power. Here, Okolite-Okoprene Self-Supporting Aerial Cable serves between a new generating plant and an old one. It contrasts strikingly with the congestion of open wiring.

With Okolite-Okoprene Self-Supporting Cable, *self-evident space economy* is matched by installation economy as it requires no separate stringing. Further savings result from the long life of this storm-safe all-weather cable assembly.

Another feature of Okolite-Okoprene Self-Supporting Cable that makes it valuable in industrial plants is this fact: *safe as well as easy* handling is assured. The cable is fully insulated with Okolite high-voltage moisture and heat-resisting insulation and protected with weather-resistant non-conducting Okoprene. For 52-page Self-Supporting Cable book available to electrical engineers and plant executives, please address The Okonite Company, Passaic, N. J.

Contrast the congestion shown in lower picture with the compact, simple installation of Okolite-Okoprene Self-Supporting Aerial Cable (above) at Weyerhaeuser's new pulp mill at Longview, Wash. Recently-erected generating plant is in background. Installation was made by Western Electric Construction Co., Portland, Oregon.



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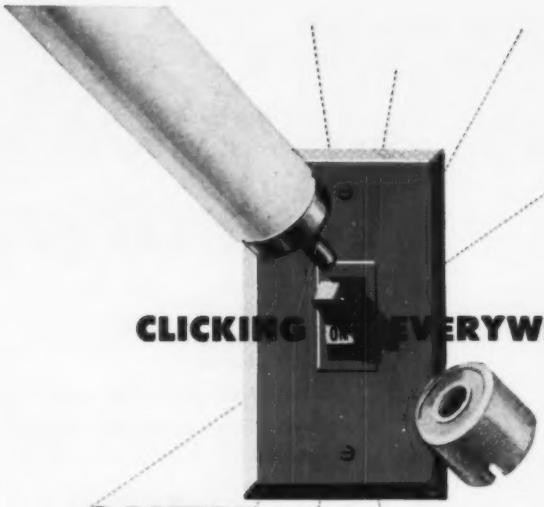
OKONITE SINCE 1878 *insulated wires and cables*



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+ Easy-to-handle—one man can get it through a door
+ Available in every two and four 40W fluorescent fixture in the entire GUTH line!

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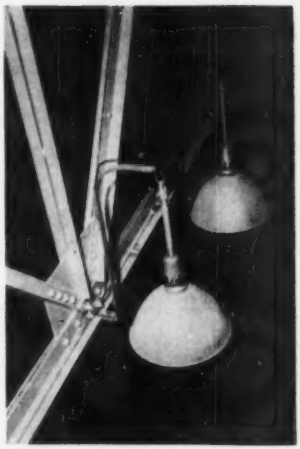
Leaders in Lighting Since 1902



3-KW. MERCURY UNIT ***on clamp-on truss brackets with flexible conduit connection to branch circuit outlet at left.***

in the conduit line on the truss chord. Supports for the 3-kw. mercury fixtures are similar in design and construction but are 17½ inches high and extend 14½ inches out from the chord. These units are suspended approximately 4½ inches above the bottom of the truss chord and are connected by flexible conduit to outlet boxes on the truss.

Fluorescent fixture brackets are approximately 17 inches high, extend 19½ inches out from the chords and have a knee brace for added rigidity. Fixture channel supports are mounted permanently (nut and bolt) to the truss brackets; keep bottom of the fixture about 7 inches above the bottom of the truss chord.

Handling Techniques For Warehouse STORAGE

The recently completed 68,000 square foot ultra-modern warehouse of the Compton Transfer and Storage Company in Boise, Idaho, uses specially designed pallets on rider-type industrial stackers to shift general merchandise and household furniture around the structure. By tiering to ceilings 18 feet high, Compton claims he is able to store in 8450 square feet the amount of household goods previously requiring approximately 18,000 square feet. And, by establishing aisle widths at 4 feet, greater storage area and correspondingly greater revenue is obtained.

Handling items such as a davenport in a 4-foot aisle requires unusual technique because the electric fork truck

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2 additional Pushmatics of the desired rating and type from his shelves for . . .

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Here's Why Industry Uses SAF-T-LAG Fuses

Jefferson

SAF-T-LAG FUSES

Provide New Wider Protection

Saf-T-Lag is needed today to protect motors and equipment, and insure against unnecessary shutdowns.

Saf-T-Lags protect against short-circuits and overloads, but prevent unnecessary shutdowns caused by harmless temporary overloads. Operating on the thermal principle they also protect panels, switchboards, and other electrical equipment in the circuit against damage due to excess heat caused by poor contacts.

Dependable protection is provided against motor burn-outs due to overloading and single phasing of polyphase motors. Because of less watt loss, there is a big saving in plants where many motors are installed.

Protect all electrical equipment and factory production with Saf-T-Lags.

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Bellwood, Illinois

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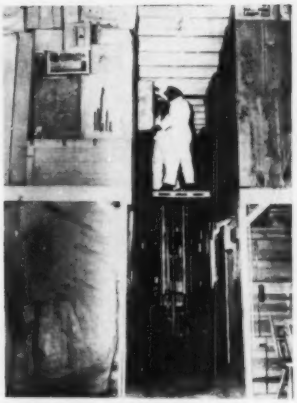

HIGH LIFT INDUSTRIAL TRUCK *with special 8-by-3-foot pallet makes it possible to operate in a 4-foot aisle and use tiering up to an 18-foot ceiling. Handling of merchandise now requires only 40 percent of former man-hours in the Compton Transfer and Storage Company warehouse, Boise, Idaho.*

cannot turn to stack its load. The problem is overcome by placing the load on a special 8 by 3-foot pallet, raising the load to the height at which it will be stored and sliding it sideways into the desired position on the rack. The pallet remains on the forks of the truck, ready for the next load. For this operation, two men ride with the load to properly store it. Combined weight of two men and a davenport is 700 pounds, well within the limit of the 3000-pound capacity, and the cantelever action is safely offset by the weight of the truck itself.

Man-hours for handling merchandise have been reduced 60 percent since these Transrider Stackers made by the Automatic Transportation Company of Chicago were obtained and the storage arrangement which is now possible has increased profits greatly.

GENIAL CO-PARTNER *of Industrial Electric Equipment Co., Dallas, Texas, motor repair firm, is J. C. Hardie. He has been in business with J. E. Hurt for about four years.*

ADVERTISEMENT

ORANGEBURG
Fibre Conduit News

MORE BUSINESS — MORE PROFITS FOR THE CONTRACTOR

VOL. 1 NO. 1 MARCH 1950 ★★★★★

MORE INSTALLATIONS IN 1950

Nocrete Saves Time Work and Money on Installations Like These

FIELD REPORTS point to Orangeburg *Nocrete* (Type 2) as the ideal conduit for single or double duct runs. Made with heavier walls for use *without* concrete encasement, *Nocrete* does a good, economical job for one or two duct installations such as factories, schools, colleges, hospitals, drive-in theaters, power, telephone and other communications systems, also service entrance, parkway and suburban lighting, airport boundary lighting.

Why Orangeburg Is The Leader

Orangeburg's experience in the fibre conduit field goes back 57 years. Since 1893, leading public utilities have used Orangeburg Conduit to protect cables underground. Today, Orangeburg is a predominating choice of utilities and municipalities—and of practically all design engineers.

Further investigation shows that Orangeburg has innovated *all* the important advancements of the fibre conduit industry. It is known as a company that stands back of its product—another reason why many consider it the fibre conduit to use—why Orangeburg is the established leader—the conduit to install for *lifetime* cable protection.

NO ELECTROLYSIS

Vital cables need permanent protection from stray currents, electrolytic action and chemical corrosion. Orangeburg Conduit—with its non-conducting properties, impermeable walls and tight joints—gives cables this protection.

DISTRIBUTED BY

GraybaR
ELECTRIC COMPANY

GOING IN THE GROUND TO STAY!

For main electrical distribution where duct banks of four or more ducts are required, Orangeburg *Standard* (Type 1) is the *preferred* conduit all over America. It is installed *with* concrete encasement—the method of installation employed by big users when putting transmission lines under ground to stay.

HIGHEST STANDARDS OF MATERIALS AND WORKMANSHIP

A trip through the Orangeburg plant shows quality standing out everywhere. You see there conduit being built for *permanence* in America's most modern and completely equipped factory—by craftsmen of exceptional skill and experience. You see why conduit, made Orangeburg's way, can give lifelong protection to cables underground—because it is non-corrosive and water-tight—because of its resistance to corrosive ground waters, its low breakage and minimum pulling friction.

First Cost is the Last Cost

In the experience of utilities, municipalities, railroads and other big users, initial and installed costs run lower when Orangeburg Conduit is used. For one reason, it permits longer runs. A second reason is its light weight and ease of installation. A third, the elimination of maintenance and repair costs. After half a century, many Orangeburg installations are still in active use, and when inspected prove to be as good as new.

WITHSTANDS HEAVY LOADS AND SOIL SETTLEMENTS

Orangeburg's unique materials have the toughness and resiliency to bear up under traffic shocks, sudden soil settlements or heavy loads without damage.

NOW BRANDED WITH ORANGEBURG TRADEMARK

Withstands Ground Acids and Alkalies

Orangeburg Conduit lines—dug up after 40 years—show no signs of deterioration from acids, alkalies, salt, grease or oil.

MORE BUSINESS IN 1950

To assure more installations in 1950, more Orangeburg Conduit is available at more distribution points through Graybar Electric Company and General Electric Supply Corporation. Electrical Contractors can therefore be surer of getting Orangeburg Fibre Conduit whenever they need it. Better product identity is another feature. The Orangeburg name is now branded on every length of Orangeburg for people to see.

More push behind the product. Extensive, year-round advertising and promotion are telling the world the whole story about the advantages of Orangeburg... the *lifetime* conduit... the *leader* and *first* choice in every city and state in the Union.

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GENERAL ELECTRIC
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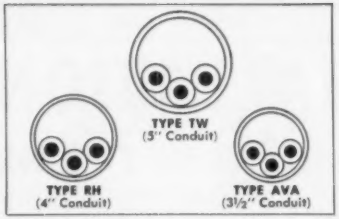
ORANGEBURG MANUFACTURING CO., INC., ORANGEBURG, NEW YORK

Advertisement

WIRING NEWS

A PERIODICAL DIGEST OF WIRING IDEAS FROM THE GENERAL ELECTRIC CONSTRUCTION MATERIALS DEPARTMENT



Dream-home Lighting For Every Type of Home

Today's prospective home buyers are harder to "sell." They insist on modern planning and conveniences . . . they look for extras . . . they demand proof of quality before they buy. That's why architects and builders recognize the value of the General Electric remote-control wiring system as a spur to added home sales.

This step-saving, new wiring system at last makes dream-home electrical control a reality. Simple and fast to install, it is easily demonstrated to the prospect. Unobtrusive flush switches at convenient locations give instant, positive ON and OFF control of any light or electrical apparatus. And, while you're demonstrating remote control, you'll have the added "sell" of the General Electric monogram.

For Low-Cost Homes

General Electric remote-control system is practical for even budget-price housing. Designed to fit in with existing techniques, remote control requires the same tools and methods needed to install present power circuits. You merely snap a small relay into knockout of outlet box. Inexpensive wire can then be run from relay to centrally-located transformer and conveniently-placed switches.

For further information why not contact your General Electric Construction Materials distributor, or check item (A) in the coupon below.

Here's How to Supply 49% More Current Per Raceway

Here's a really easy way to increase circuit capacity *without* increasing raceway size —just rewire with General Electric Deltabeston® asbestos-varnished cambric cables!

Insulated with heat-defying asbestos, Deltabeston AVA cables meet the requirements for small-diameter cables in heavy-load jobs involving high temperatures. That's why at normal ambient temperatures (in dry locations, as specified by National Electrical Code) AVA cables can deliver up to 49%* more current per raceway than ordinary types of building wires.

Saves on New Work

In new construction, too, because of their heat-resisting asbestos insulation, AVA cables often permit smaller conductors, reduced raceway sizes, and over-all savings on weight.

If you have not considered asbestos-varnished cambric cables for space and materials savings, you'll do well to figure them in on your next heavy-load job. It may amaze you to discover what real savings you can offer with Deltabeston AVA cables.

For further information, consult your local General Electric distributor or check box (B) in the coupon below.

** (This figure was worked out for AVA cables at 1000 MCM. Other sizes offer similar savings.)*

You Know You're Right With "G-E White"

There's no question about it. You get top wiring protection when you use General Electric white rigid conduit.

Carefully controlled in manufacture from raw material to final inspection, G-E White offers the advantages of a uniform, high-quality product. Top-quality steel, ***hot-dip-galvanized***, inside and outside, means years of protection from atmospheric corrosion. Smooth Glyptal® finish adds *plus* protection, makes wire pulling easy and fast.

During installation you'll appreciate the uniformity of G-E White. You'll like the way it cuts waste by eliminating flat bends. You'll like its sharp, clean threads.

For top protection use General Electric white rigid conduit. And remember General Electric also supplies a complete line of fittings and accessories. For information on conduit, check box (C) in coupon.

Light Weight Makes Light Work Of Residential Wiring

Light weight . . . small diameter . . . easy stripping. These features make General Electric PVX® nonmetallic-sheathed cable a real time saver in all types of residential work.

Glass-and-cotton braid resists both moisture and flame. Individual conductors are insulated with a Type T thermoplastic compound and spiral-wrapped with impregnated crushed-paper armor to provide maximum dielectric and mechanical strength. Check PVX at your local G-E distributor's, or check box (D) in the coupon.

Look For The Red Reset Button For Improved Lighting

For more satisfied customers . . . fewer call backs . . . make sure you replace worn-out fluorescent starters with General Electric Watch Dog® starters—the starter with the red reset button.

Watch Dog starters automatically cut failing lamps out of the circuit—eliminate annoying flicker and blink. They protect ballast and internal fixture wiring from expensive "burn-outs." So, when you specify or buy, be sure to ask for Watch Dogs!

Section K3-318
Construction Materials Department
General Electric Company
Bridgeport 2, Connecticut
Please send me free information on:

A ☐ Remote Control
B ☐ AVA Cables
C ☐ White Rigid Conduit
D ☐ PVX Cable
E ☐ Watch Dog Starters

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

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61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
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want more information on products or services advertised?

want advice on a technical problem?

want to ask a question and get a helpful answer?

want interpretation on a code provision?

Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

other problems? turn the page for the answer.

Dear Editors:

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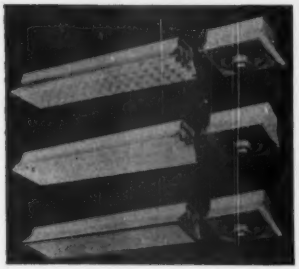
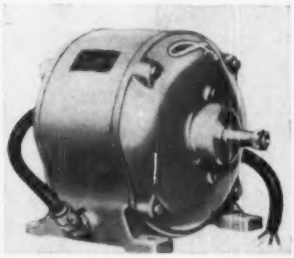
Product News



Shallow Troffer Luminaire (1)

The new type TS shallow troffer fluorescent luminaire with incandescent spotlighting is available. The design requires only 7¾ inches above the finished ceiling, and is installed by attaching the housing to "U" bracket supports. Three types of shielding are available: louvers, plain ribbed glass, and prismatic lens. All hinge to the basic housing and are completely interchangeable. Basic housings are supplied in 4-foot lengths, both 2 and 3 lamp models. A 2-lamp, 8-foot unit is available that accommodates the 96-inch T-12 lamp operated at 425 ma. Type SR-150 companion swiveling incandescent spotlight unit is designed for use as an individual recessed unit, or within rows or groups of TS troffers. It utilizes a 150-watt, PAR projector lamp, and is shielded by a concentric ring louver.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

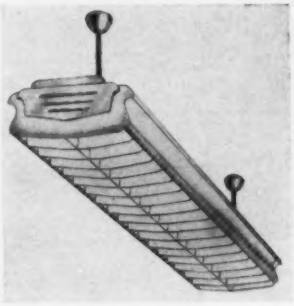


Loom Motor (2)

Announcement has been made of the development of a new ball bearing loom mootor. The "hour glass" construction permits motors to be used as replacements for the older style loom motors of less hp capacity, and for converting group driven looms to individual motor drives without the necessity for extensive modification. Frame is also suitable for new high speed looms. Some of the design features are—heavy duty, factory lubricated ball bearings, securely locked in place to provide ample end thrust capacity, special rotor design which permits loom to more fully utilize the kinetic energy of the large diameter rotor. Available in ratings of 3¾ hp. to 2 hp. It is available in the 214 and 216 frames for use on old style looms and in the NEMA 224Y and 225Y frames for installation on new looms.

The Louis Allis Co., Milwaukee 7, Wis.

(3)

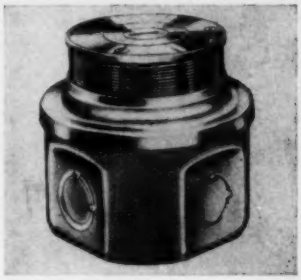


FLUORESCENT LIGHTING FIXTURE, ***known as Visualizer, is recommended for school installations. The series includes 4 ft. units for two 40 watt fluorescent lamps, 4 ft. and 8 ft. units for the new T12, 430 ma slimline lamps, and 8 ft. units for T8 slimline lamps. Fixtures may be hung individually or in continuous runs. Made by Garden City Plating & Manufacturing Co., 1750 N. Ashland Ave., Chicago 22, Ill.***

Tester (4)

A new model, 410A, of the Mini-volt voltmeter, featuring an expanded scale centered on the 110 and 220 line volts, has been announced. It is accurate to within 2 volts at 110 volts ac. All features of Model 400B are retained in this new model. The 12 inch flexible test leads are tipped with heavily insulated test prods. It can check voltage, ac or dc; tell whether ac or dc; check for continuity; check blown fuses; locate grounded components; warn of live wires; etc.

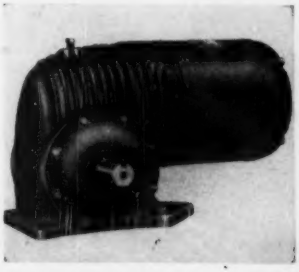
Industrial Devices, Inc., Edgewater, N. J.



Floor Box (5)

Announcement has been made of a new Universal floor box that will adapt itself to any floor box requirement. It features an adjustable, leveling top, is designed for installation in either a one-stage or two-stage floor construction and provides a smooth floor surface. By permitting a variable adjustment of the finishing cover of from ⅛ inch to ½ inch, this box can be adapted to meet the varying thickness of linoleum covered floors or of finished floors of cement, terrazzo, tile, or wood floors on sleepers. Box diameter is 4 in. by 2⅜ in. with four flattened sides for knockouts, plus a ½ inch knockout in the bottom. It carries Underwriters' approval.

Frank Adam Electric Co., 3650 Windsor Place, St. Louis, Mo.



Gear Motor (6)

A new 1½ hp gear motor is available. It is for operation on single or polyphase alternating or direct current. Range of speeds that may be obtained in these motors are from 25 to 280 rpm. Other features are—two moving parts, the armature shaft and output shaft; four bearings, two ball and two roller; and gears are "worm type."

Century Electric Company (Gear Motor Division), 1806 Pine St., St. Louis 3, Mo.

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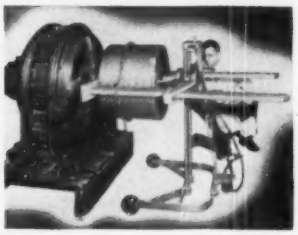
1639 walnut street chicago 12, ill.

Meter (7)

A new portable radiation detector, the long-probe Gamma survey meter, which enables the operator to measure radio-activity from a distance, has been announced. It can be used for monitoring areas in which radioactivity is suspected or for other types of radiation metering. A detector located at the tip of a four-foot-long probe converts radioactive emanations into electrical energy. This detector consists of an electronic tube and a phosphor, which gives off light in the presence of radioactivity. At the other end of the instrument, a dial is activated by amplified energy from the tube. It registers the amount of radiation exciting the phosphor four feet away. Detector is powered by 1,000 volts induced from low voltage batteries.

General Electric Company, Schenectady 5, N. Y.

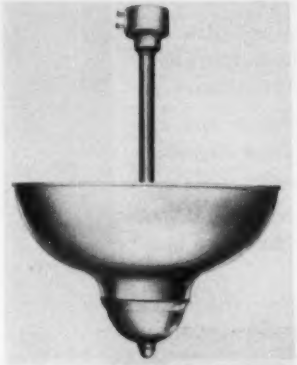


Pulley Puller (8)

A new heavy duty portable hydraulic pulley puller, rated at 50 tons pressure, has been introduced. It is especially designed to remove large pulleys, wheels, gears, etc., from shafts, handling jobs beyond the capabilities of the smaller units. In the operation, two feet at the ends of adjustable arms are placed behind the object to be removed and a ram is placed in position against the end of the shaft. Pressure applied by the ram against the shaft by means of a hydraulic jack loosens and removes the object. The 50 ton models has a special heat treated alloy steel cross beam, puller arms and feet. Pressure exerted by the ram is regulated by a 3-speed hydraulic pump. Pulleys as large as 42 inch in diameter with face width up to 48 inches can be handled.

Industrial Engineering Equipment Co., 122-124 East Fourth St., Davenport, Iowa.

(9)

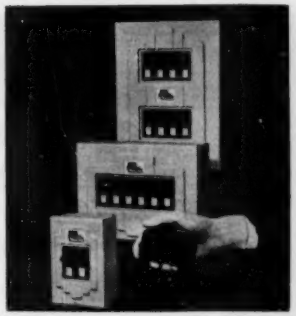


ISLAND LIGHT, mushroom type, for area lighting has been announced. Unit is adaptable for low mounting heights. Has multiple socket arrangement to accommodate three 200 watt lamps. Lamps burn base up. Dome has three ½ inch tapped opening for mounting flood or spot lampholders. Finished in porcelain or ultranamel, provided with ¾ inch riser and slip fitter for 2 inch pipe. Manufactured by Steber Manufacturing Co., Broadview, Ill.

Control Unit (10)

A double duty charge control unit has been announced. It is an accessory for automatically charging two batteries from a single-circuit motor generator battery charger. It is possible to charge two like batteries automatically, resulting in twice the battery charging capacity from one single-circuit motor generator charger. Both batteries can be placed on charge simultaneously at the end of a working shift and be re-charged by time work is resumed in the morning. Double duty unit is a control unit operating in conjunction with a standard battery charger and is housed in a steel box mounted on charger control cabinet.

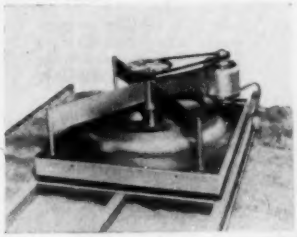
The Hertner Electric Company, 12690 Elmwood Ave., Cleveland 11, Ohio



Load Centers (11)

A new line of load centers using smaller magnetic breakers has been developed. Available in models for 2, 4, 6 or 8 circuits, these smaller load centers are made possible by newly designed circuit breakers of considerably smaller overall dimensions. Operating on the fully magnetic principle, these breakers are interchangeable with other popular types of single pole individually housed breakers. Depth is 3 inches to permit flush installation in thin walls. A ¼ inch plaster line adjustment is provided. Breakers are available in ratings of 10, 15, 20, 25, 30, 35 and 50 amp. Available in both surface and flush mounting types. Listed by Underwriters' Laboratories, Inc.

Murray Manufacturing Corp., 1250 Atlantic Ave., Brooklyn 16, N. Y.



Attic Fan (12)

A new attic fan with automatic ceiling shutter has been introduced. This vertical discharge fan is designed for low-cost installation. Fan, motor and suction box are all in one unit that is placed on the attic floor. A heavy rubber base provides an air seal and cushion between the fan frame and attic floor. Unit is 17½ inches high. Automatic ceiling shutter is installed by attaching to wood frame of ceiling opening with screws. Available in 4750 CFM and 6800 CFM capacities with air delivery ratings certified.

Hunter Fan and Ventilating Company, 400 S. Front St., Memphis, Tenn.

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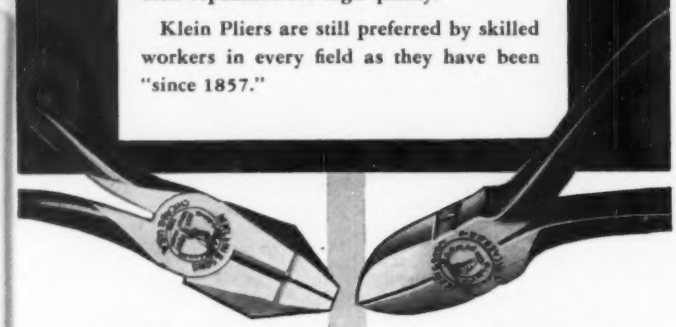
the Best

• Ever since the first communication and power lines were strung, Klein Pliers have been the favorite tools of electrical workers.

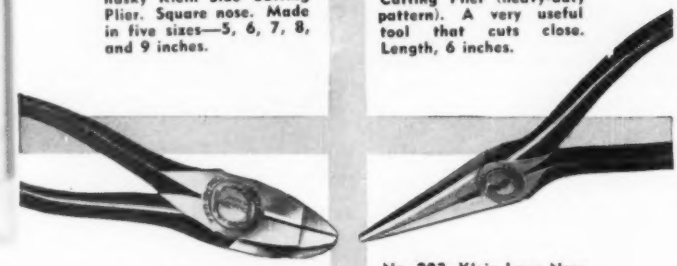
Today, Klein Pliers are made with the same exacting care that has won these tools their reputation for high quality.

Klein Pliers are still preferred by skilled workers in every field as they have been "since 1857."



No. 201. Original pattern husky Klein Side Cutting Plier. Square nose. Made in five sizes—5, 6, 7, 8, and 9 inches.

No. 242. Klein Oblique Cutting Plier (heavy-duty pattern). A very useful tool that cuts close. Length, 6 inches.



No. 201 NE. The famous "streamlined" Klein Side Cutting Plier. Made in five sizes—5, 6, 7, 8, and 9 inches.

No. 203. Klein Long Nose Plier. Long reach of jaws permits getting into difficult places. Made in 6 and 7-inch sizes.

The Klein Pocket Tool Guide, showing the Klein line and containing useful tool information, will be mailed on request.

Established 1857

Mathias Established 1857 KLEIN & Sons Chicago, Ill., U.S.A.

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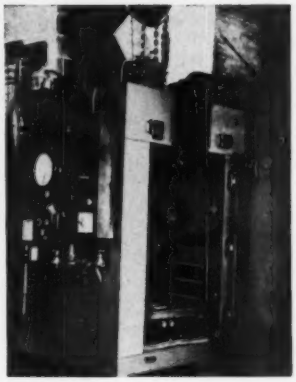
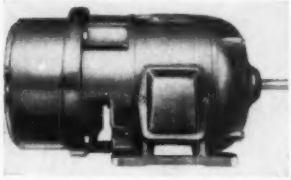


Burning Oven **(13)**

For burning out motor windings preparatory to re-winding, a new front-loading oven has been announced. Oven is equipped with controls which maintain temperatures within close limits during heating-up, burning, and cooling cycle. Oven is loaded from front. Small motors may be placed by hand; heavy ones can be set in by using a chain hoist from an overhead rail. A door in the top of oven permits passage of hoist. Oven is insulated and protected with standard safety devices. It is fast fired. Heat controls can be set up to adapt oven for such jobs as drying out water-damaged motors, baking enamel on frames, etc.

George Koch Sons, Inc., Evansville 4, Ind.



Brake Motor **(14)**

Announcement has been made of a new brake motor. Features are the prelubricated for life cartridge bearings and a new brake lining that eliminates need of adjustments. Heart of the new unit is the recently developed brake which can be mounted on dripproof, splashproof, or totally-enclosed motors to make a matched brakemotor in ratings from 1-60 hp. It has bonded metal brake linings, which are not affected by heat, cold, dampness, salt water, fungi, grease or oil. Available separately for mounting on NEMA standard D flange motors in frames 203-326 or C face motors in frames 365-405 with standard double shaft extensions.

Crocker-Wheeler, Newark, N. J.

Busduct **(15)**

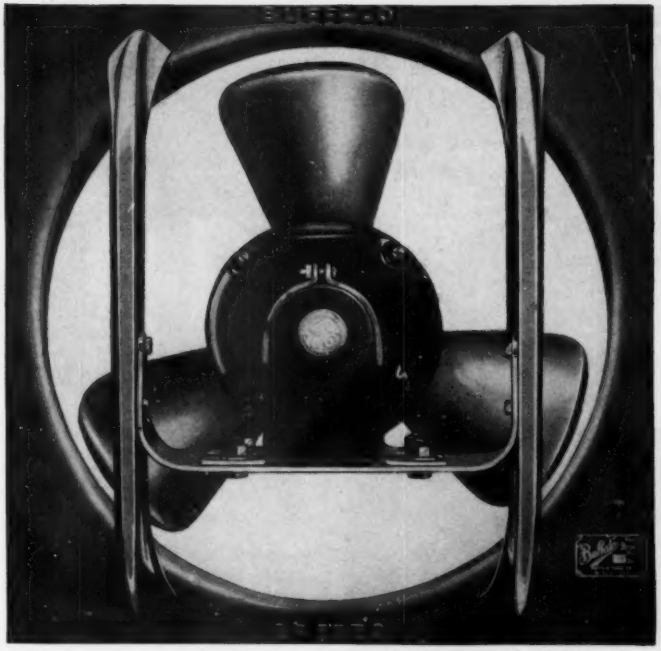
A new midget-size busduct of 50 amp. feeder capacity, known as Power Plugin, has been developed. It has been approved by Underwriters' Laboratories for equipment requiring connections for ½ to 3 hp. motors, 240 volts or less, ac or dc, or for 7½ hp. maximum with dual-element fuses. The duct is 3 inches wide by 2 inches deep, and is made in standard 5-foot and 10-foot lengths with plugin outlets every 20 inches. Additional outlets and longer lengths are available on specification for special application. New and smaller plugin units, fitted with standard 30-amp. fuse connections, have also been developed for this power distribution system. Power Plugin can be fastened by straps to the wall, ceiling or along the back of or under a machine bench, or supported by hangers from the ceiling or roof.

Frank Adam Electric Co., 3650 Windsor Place, St. Louis, Mo.

Motor Starter **(16)**

A new motor sentinel, a manual motor starter with positive bimetallic over-load protection, is available. Especially suited to controlling and protecting small motors used with fans, pumps, small machine tools, grinders, stokers, etc., the starter fits any standard 2½ inch wall box. For surface mounting, it is available in an alloy enclosure with Bonderized baked enamel finish. Special cast iron enclosures are provided for watertight and explosion-proof applications. Positive operation is provided by means of the overcenter toggle mechanism. All terminals are at the front, with line terminals at the top, and load terminals at the bottom.

Westinghouse Electric Corp., Pittsburgh 30, Pa.



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Contractor's Favorite

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"Buffalo" **BREEZO FAN**

- Rugged square panel for quick installation anywhere.
- Quiet, efficient fan for years of heavy-duty air moving.
- Operates practically without attention —simple, sturdy construction.
- 6 sizes, 8" to 24", all with high grade standard-make motors.

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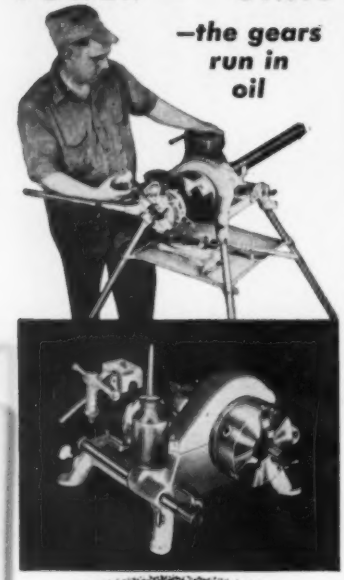
POWER UNITS
—the gears run in oil



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THESE 6 EXCLUSIVE
BEAVER ADVANTAGES

Beaver Model-C Portable Power Units offer you the most in ruggedness and trouble-free performance because of these six exclusive advantages:

1 All gears are fully enclosed — run in oil.
2 Safety switch-lock and chuck wrench holder — patent pending.
3 Patented safety lock — holds pipe tool handle firmly.
4 Heavy-duty ⅛" to 2" chuck — full size, full range.
5 Cast steel-iron housings insure greatest strength and maximum stability when driving geared cutters and threaders.
6 Conveniently located heavy-duty, weatherproof motor provides plenty of power. Properly located for safety, cool operation, longer brush and armature service.

Write today for catalog and prices. Address Beaver Pipe Tools, Inc., 232-300 Dana Avenue, Warren, Ohio, U. S. A.

50 Years of Friendly Service

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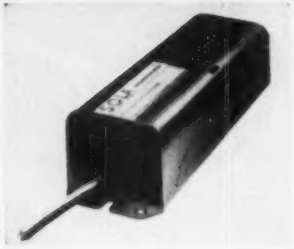
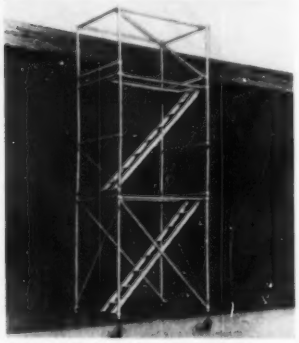


Ballast (17)

An addition has been made to the "Sequenstart" line of fluorescent ballasts. It eliminates need for starter switches and is for the following lamps: Two 48-T-12 single pin lamps; two 48-T-12 I-S bi-pin lamps and two 60-T-17 low brightness lamps. The constant voltage principle is employed. When line voltage varies from 90 volts to 130 volts, the "Sequenstart" ballasts vary light output by 4 percent. Lamps are wired in series and started in sequence. Lamps are started in two rapid stages, partial light being delivered at the instant the switch is closed. The second lamp in the series starts within a second or two.

Sola Electric Co., 4633 West 16th Street, Chicago 50, Ill.



Scaffold (18)

A new sectional-type aluminum rolling scaffold has been announced. It is recommended for many types of overhead and sidewall work such as office building maintenance and installing and repairing lighting fixtures. Available in two types, stairway and ladder. All parts except casters and platforms, are made of aluminum alloy. Scaffolds are supplied in one or more sections, with guard rails. The bottom section, including non-elevating casters, is 7 ft. 3 in. from ground to first platform. Each additional section is 6 ft. 8 in. high. Base dimensions are 4.5 by 6 ft.

Patent Scaffolding Co., Inc., 38-21 12th Street, Long Island City 1, N. Y.

Reflector Bulb (19)

A new 300 watt weatherproof incandescent reflector lamp suitable for outdoor lighting applications such as signs and billboards, general floodlighting of service stations and factory yards, roadside stands, home sports areas and gardens, has been added to this line of "built-in" reflector lamps. The new R-40 lamp is enclosed in a heat-resistant glass bulb which absorbs the thermal shocks. It operates on 115, 120 and 125 volts. It has a mogul screw base. Bulbs can be mounted either singly or in clusters.

Sylvania Electric Products, Inc., 500 Fifth Avenue, New York, N. Y.

Boxes (20)

A new line of terminal and conduit boxes for electric motors has been announced. They are made of pressed steel to eliminate cast iron boxes. Available in three sizes; size 1 will take conduits from ½ inch to 1 inch; size 2 will take 1 in. and 1¼ in. conduits and size 3 will take conduits up to 2½ inches. Motor manufacturers may specify holes in back and bottom to suit their standard designs. For motor repair shops a standard line is offered.

Kolton Electric Manufacturing Co., 123 New Jersey Railroad Ave., Newark 5, N. J.

Reflector Spotlight (21)

A new 300 watt R-40 reflector spot lamp has been developed. It has a heat-resistant glass bulb and mogul screw base. Inside of the face of the bulb is lightly frosted. Intended for outdoor use, the new spot lamp was designed to fill a need for a lamp to provide a small spot of light brighter and for longer distances than can be obtained with the flood lamp. They are desirable for existing and new lighting applications at service stations, garages, parking lots, arenas, industrial plants and yards. The heat-resistant glass bulbs withstand the thermal shock of drops of water, oil and grease.

General Electric Co., Nela Park, Cleveland, Ohio

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BRONCO 60

CERTIFIED

We certify that the jacket of all cord or cable branded "Bronco 60 Neoprene Certified" contains not less than 60% weight of new Neoprene.
CERTIFIED
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First Again

FIRST to certify the Neoprene content and so brand each piece of wire.

FIRST to introduce a cord and cable jacket containing 60% by weight of Neoprene.

For many years, 60% by weight of rubber or Neoprene has been the recognized standard of highest quality in electrical cord and cable jackets. Since the development of Neoprene, manufacturers have been endeavoring to produce such a jacket. Now Western has reached this goal!

The result of years of extensive research, BRONCO 60 *CERTIFIED* brings you electrical cords and cables containing 60% by weight of new Neoprene. Western is the only manufacturer to offer this *Certified* protection.

Every carton and reel of BRONCO 60 *CERTIFIED* carries a certificate signed by a registered, professional engineer. This is your assurance of more value for every dollar invested in cords and cables. Longer lasting cold rubber insulation — soft annealed electrolytic copper strands, moisture repellent cushioning fillers, assembled to provide maximum flexibility: these features, combined with the new BRONCO 60 *CERTIFIED* Neoprene jacket, give you longer lasting, safer and more economical cords and cables . . .cords and cables still more resistant to oils, chemicals, acids, cutting and abrasion. *AND* every piece is branded "BRONCO 60 *CERTIFIED*," with the size, number of conductors and voltage, for added protection.

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SAVE scores of man hours on overhead installations and maintenance with rapidly assembled, mobile

Aluminum Alloy

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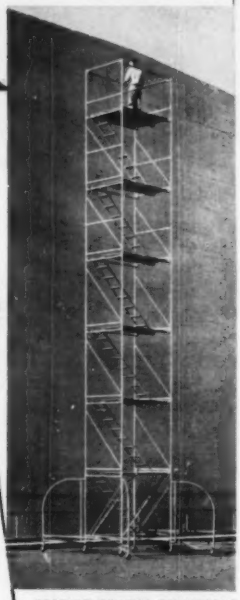

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WALTER G. KOLB

December 13, 1949

Up-Right Scaffold Co.
1421 Chestnut St.
Philadelphia, Pa.

ATT: MR. ELYNNE ALLEN

Dear Mr. Allen:

About a year ago, we purchased from you, an Up-Right Scaffold, which we have used almost constantly since. We think it is the finest equipment that we have ever purchased and would not sell it for twice what we paid for it, if it were not available.

It has not only been a money saver for us, but it has given our customers confidence in us, and many times our customers have expressed their approval of same.

We are just completing the re-wiring of a large group of buildings, and this scaffold was a "lifesaver" as we could just roll it from room to room.

Kindly ship by express the additional scaffold that were ordered today. Thanking you, we are,

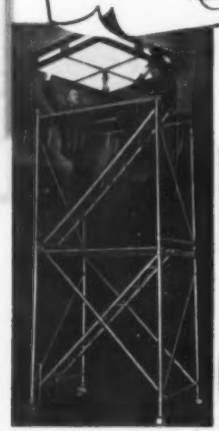
Sincerely and Electrically,

Kolb Electric

By

MOBILE TOWER SCAFFOLDS up to 45 ft. and higher take only 1 to 15 minutes to erect. Safety tread stairway completely within structure.

READ W. G. Kolb's Actual Letter!



MOBILE TOWER SCAFFOLDS available in desired number of 6 ft. or shorter section units

Rolled easily from position to position. Stronger than structural steel yet one third the weight. Legs are instantly adjustable for perfect levelling on uneven floors or stairways. No wrenches, wing nuts, bolts or loose parts.

MOBILE 6 FT. or 10 FT. SPAN SCAFFOLDS take only 1 minute to erect

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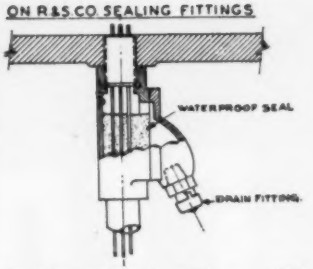


Breather & Drain Valves (22)

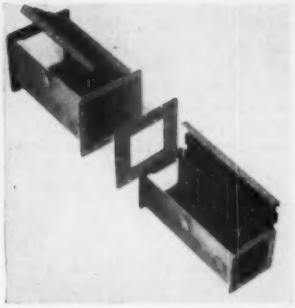
Announcement has been made of a new type "R" breather and drain valves made of high tensile aluminum alloy with anodized finish. This alloy permits use with either iron or aluminum enclosures without deleterious effects of electrolysis. They are recommended for use in conjunction with conduits and enclosures that form parts of a system exposed to weather or warm moist atmospheres. Drain valve is furnished with a $\frac{3}{8}$ inch or $\frac{1}{2}$ inch tapered pipe thread to fit standard $\frac{3}{8}$ in. or $\frac{1}{2}$ in. threaded conduit outlets.

Russell & Stoll Company, Inc., 125 Barclay St., New York 7, N. Y.

Tool (23)

Announcement has been made of a new and improved powder-actuated fastening tool, known as Drive-It "300." One of the features is "controlled power" whereby the penetration of the fastening "pin" can be varied for materials of different densities. Other features are the flangeless "drive-pins," 3-way safety, semi-silent operation, "twist of the wrist" firing, a built-in safety pad, and an automatic extension barrel which enables the user to get in narrow places without special extension barrels.

Powder Power Tool Corp., 0719 S. W. Woods St., Portland 1, Oregon



Bushing (24)

A new bushing, designed to provide quick, convenient means of effecting reductions from six inch to four inch wireways has been announced. Use of this bushing will permit contractors to branch off from main wireway and power lines to smaller outlets without disturbing the appearance and efficiency of the installation. Made of heavy gauge metal, the bushing is 7½ inches square with a four inch square center opening.

Keystone Manufacturing Co., 23328 Sherwood Road, Center Line, Mich.

Grounding Reel (25)

Series 200 portable grounding reels are available for use in connection with the generation of static charges on fuel servicing equipment during the transfer of combustible fuels. The reel keeps the grounding cable off of the ground. Reel is equipped with 20 feet of 3/32 in. diameter phosphor bronze cable and a one foot phosphor bronze pigtail to fasten to ground connection. Universal mounting bracket for overhead model for installation on either ceiling or wall. Reel for field installation is equipped with an adaptor to secure it to a ⅝ in. diameter grounding rod. It has a roller bearing arrangement. Cable is paid out or retracted as desired.

Benjamin Reel Products, Inc., 10700 Broadway, Cleveland 25, Ohio

Silver Plating Powder (26)

A new method of silver plating high amperage electrical connections on the job has been developed. It is especially desirable for improving continuity of electrical service and reducing maintenance time and costs. The silver plating powder deposits a coat of silver that will not peel off and gives cool maximum conductivity for copper, brass or bronze contacts. It is harmless to the user and easy to apply.

Cool-Amp Company, 8603 S. W. 17th Ave., Portland, Ore.

No. 7868

Electricity is doing more and more outdoor work these days — and our line of rugged, weatherproof wiring devices is one of the reasons why. In our complete line, there's a receptacle or switch for every application. Every unit offers long-lived, dependable protection against outdoor weather and excessive indoor humidity. Switches and receptacles are also combined in attractive one and two gang units. Each unit comes assembled ready for installation and furnished with weatherproof mats. Snug fitting covers automatically close when plug is removed thus keeping receptacles clean and dry when not in use.

Check into these versatile switches and receptacles today — see how they meet your most exacting application requirements, your own standards of uniform high quality.

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DIVISION

WIRING DEVICES
ENCLOSED SWITCHES

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
HARTFORD, CONNECTICUT

SOLDERING IS A CINCH

when you know these SIMPLE TRICKS!

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No matter how much you know about soldering, there's always a trick that will make it easier. This little 20-page pocket guide is crammed full of such time-and-trouble savers.

Without wasting words, it covers the whole soldering operation—points out DO's and DON'T's—refreshes your memory on difficult points—suggests methods that help you work faster. Yet there's no hard studying, no tough technical talk. Every word is plain everyday English and every point is made clear by easy-to-understand illustrations.

Get this handy Soldering Guide today, and keep it on your bench for ready reference. It's a real handbook of professional soldering—*not* a catalog. Just mail the coupon with 10c in coin and we'll send your copy at once.

When you send for your Guide to Easy Soldering, be sure to ask about the New Weller Soldering Guns. They're a handful of convenience, better from tip to grip.

WELLER MANUFACTURING COMPANY

Weller Mfg. Co., 815 Packer St., Easton, Pa.

Enclosed find ten cents (10c) for which please send my copy of the Weller "Soldering Tips".

☐ *I am also interested in the new Weller Soldering Guns. Please send Catalog Bulletin.*

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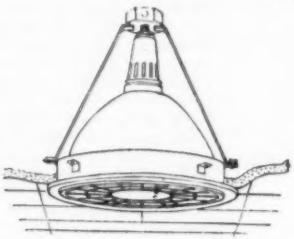
Transformer (27)

New larger-sized, air-cooled transformers of an improved design have been announced. Known as AmerTran Type GS, they are manufactured in standard ratings from 15 to 200 kva, single-phase, 60 cycle, and with either 240/480 or 600 volt, high voltage windings. Low voltage windings rated 120/240 volts are suitable for supplying lighting, motor and distribution loads. Type GS provides adequate accommodations for wiring connections in all types of installations. They are designed for floor or platform mounting in indoor service, except that hanger brackets to enable wall mounting are supplied with the 15 and 25 kva. sizes.

American Transformer Company, 285 Emmet Street, Newark, N. J.

(28)



HIGH BAY ***Alzak aluminum gym lights in both exposed and recessed types have been announced. Reflectors protected with heavy gauge wire guards. May be used with or without concentric louvres for shielding. Recessed types are hinged in plaster ring for servicing. Exposed types have hinged bottoms. Manufactured by Edwin F. Guth Company, 2615 Washington Avenue, St. Louis 3, Mo.***

Motor (29)

A new modified base-ventilated motor, designed specifically for external applications such as driving power station auxiliaries mounted out-of-doors, has been announced. Available in ratings ranging from 200 to 3000 hp, the motor was developed for outdoor installations where the totally-enclosed fan-cooled units are not available. It is designed to be mounted on a concrete base which is raised from the ground to allow contaminated ambient air to flow through the foundation at high velocity, as in a storm. After circulating through the motor, the ventilating air is exhausted from the top. In case air enters the exhaust ports during a heavy storm, adequate elimination and drainage are provided.

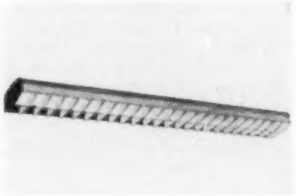
General Electric Co., Schenectady 5, N. Y.

Control Stations (30)

A new line of oil-tite control stations and units is available. Especially designed for machine tool control and other heavy-duty installations, they can be used in any desired combination in the stations. Units and nameplates can be rotated 90°, 180°, or 270° to enable mounting in any position. Terminals on the contact block are reversible for front and rear connection. For surface mounting, the stations are available in die cast enclosures with Bonderized baked enamel finish. Contact blocks can be mounted in the base, eliminating flexible leads from box to cover.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

(31)



FLUORESCENT FIXTURE ***known as "Fleetline", has been added to this line of lighting equipment. Construction provides ribbed, plastic sides with deep baffle type louver held in place by three acorn nuts, and which also serves as cover plate for wiring channel. Louver and plastic sides are removable for maintenance. Can be mounted in continuous flush end-to-end series or pendant mount. Available in both 8 and 4 feet for the new single pin slim T12 lamps. Made by Cornwall Fixture Company, Cornwall, N. Y.***

NEW Revolutionary

SERIES TS 50

INTER-MATIC TIME SWITCHES

A COMPLETE LINE

- SINGLE POLE
- DOUBLE POLE
- POULTRY DIMMER
- LOW VOLTAGE
- DOUBLE THROW

with these OUTSTANDING features:

1 ***Interchangeable Switches***
Any model can be converted to any other model simply by changing switch assemblies.

2 ***Plug-in Adapter***
Any model can be converted to a portable plug-in unit by merely attaching a few small parts.

3 ***Front Mounted Motor***
A front mounted motor with an observation window enables immediate checking of operation without removing the mechanism.

4 ***Wide Application***
Up to 12 "on" and "off" operations every 24 hours—no special dial is required when adding trippers.

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Please send me FREE of charge complete information on the new series TS50 Inter-Matic Time Switches. Include details of the Special Introductory Offer!

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My Name _____ Zone ____ State _____

City _____

INTER-MATIC TIME SWITCHES

How to spot trouble before it starts!

HOOK-ON VOLT-AMMETER

for fast electrical checks!

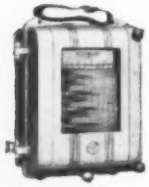
AF-2 LOAD VISUALIZER
5 instruments in one—measures watts, volts, amperes, vars, power factor.

You can make electrical checks in a hurry—and easily—with the G-E hook-on volt-ammeter. To measure voltage, just clip the voltage leads to convenient terminals or binding posts. There's no opening of conductors—no interruption of service.

Among its many uses, the hook-on is ideal for motor testing. In a jiffy you can learn whether motors are overloaded or perhaps under-loaded to a wasteful degree. Costly shutdowns of motors, transformers, other loads can be prevented by periodic checks.

The hook-on volt-ammeter has six ranges: 0-15/60/150/600 amps, and 0-150/600 volts a-c. Extension poles available for use on high-voltage circuits or hard-to-get-at locations. For this and other handy G-E testing instruments see your local G-E distributor or write Apparatus Department, General Electric Company, Schenectady 5, N. Y.

AP-9 A-C VOLT-METERS AND AM-METERS
For general testing—highly accurate, sturdy.



CF RECORDER
Uses no ink—inexpensive records.

Manufacturer's suggested retail price, AK-1 hook-on volt-ammeter **$74.75**

GENERAL ELECTRIC

602-171

Soldering-Unit (31)

A new soldering unit, operating on the conduction principle, is now available for all types of soldering operations, including silver soldering and brazing. Called the Wassco Glo-Melt, it has a 24 heat selector. Upon contact with work the tip of copper jacketed carbon "pencil" glows red and the flux-core solder flows when touched to the pieces being joined. Unit weighs about 25 lbs. and is 7 in. by 7 in. by 7 in.

Wasserlein Mfg. Co., Inc., 7400 Third Avenue, No., St. Petersburg 6, Fla.

Product Briefs

(33) Fluorescent **lamp disposal** operates on 12 gallons of water and 110 volts. Disposes of 100 lamps in ten minutes. Made by Laduby Company, New Haven, Conn. . . . (34) Reliance Electric & Engineering Co., Cleveland, Ohio, has announced a **V-S drive** in ¾ to 2 hp. sizes. . . . (35) Marcus Transformer Co., Hillside, N. J. has redesigned its line of **dry type general purpose lighting transformers.**

(36) Superior Electric Company of Bristol, Conn. has announced the new design of Powerstat variable **transformers**, type 116 and 216. . . . (37) Booster **heaters** to be used with dishwashing machines and kitchen sink heaters are made by Industrial Engineering & Equipment Co., St. Louis, Mo. . . . (38) Sterling Electric Motors, Inc., of Los Angeles has announced that its variable speed **motor**, "Speed-Tro.", is now available in the "Klosd-Tite Fan-Cooled" design.

(39) Gedney Electric Co., New York, N. Y. has introduced offset **conduit nipples** which cut installation time by simplifying the job of box alignment. . . . (40) Shatterproof underfeed **oilers** and sump bottles are being manufactured by Trico Fuse Mfg. Co., Milwaukee, Wis. . . . (41) GS Hy-Rate **battery cell tester** No. 17, locates defective battery cells in or out of cars, trucks, airplanes, etc. It is made by General Scientific Equipment Co., Philadelphia, Pa.

(42) Edwin L. Wiegand Company, Pittsburgh, Pa. has announced a new dished ring **heater** for clamping to round tank bottoms. . . . (43) The Dual-unit, **automatic timing device**, manufactured by Industrial Timer Corp. of Newark, N. J. has two individual timing elements, each able to control a specific operation, and accommodated in a single housing. . . . (44) Eastern Industries, Inc., New Haven, Conn. has developed a new electronically controlled **metering pump.**

(45) Crescent Tool Co., Jamestown, N. Y., has introduced a linemen's

round nose **plier**, No. 2150—8 inch. . . . (46) International Rectifier Corp., Los Angeles, Calif. has developed a new hermetically sealed selenium **photoelectric cell**. . . . (47) Litezon, is an automatic **emergency light** that provides protection when light supply fails, fuses blow, short circuits occur. It is manufactured by Chisholm Manufacturing Co., Cambridge, Mass.

(48) General Electric Co., Pittsfield, Mass, has issued a technical report on a **silicone dielectric compound** called G-E 81083. It forms a waterproof seal and is unchanged by temperatures from —70F to 450F. . . . (49) A new molybdenum-base **lubricant** called "Liqui-Moly" has been developed by the Lubricants Division of The Lockrey Company, College Point, N. Y. . . . (50) A new Linemaster twin compact foot treadle **switch** has been introduced by Simonds Machine Company, Inc., Southbridge, Mass.

(51) CSP rural distribution **transformers** for operation on 25-kv multigrounded systems are available from Westinghouse Electric Corporation, Pittsburgh, Pa. . . . (52) Victor Saw Works, Inc., Middletown, N. Y. has introduced a new shatterproof high speed steel **hacksaw blade**. . . . (53) Abrams Instrument Corp., Lansing, Mich., has announced a new three or four-digit precision **counter**, adaptable to unlimited industrial use.

(54) International Morse Products, Cleveland, Ohio, has developed a low cost fire protection available with new home **alarm system**. . . . (55) A new circular **saw attachment** for use with hand drills has been announced by Federal Engineering Co., New York, N. Y. . . . (56) Hobart Brothers Co., Troy, Ohio has introduced the Electro-Mizer, a remote start-stop **switch** with arms providing finger-touch control for welding operations.

(57) Ware Fuse Corporation, Chicago, Ill. has added to its line a complete series of powder packed **fuses** in 250 and 600 volts and from 3 to 600 amperes. . . . (58) Indoor, Type MR through-type current **transformers** for low-voltage metering indoors with or without thermal demand meters, are available from Westinghouse Electric Corporation, Pittsburgh, Pa. . . . (59) George C, Borthig Co., East Rutherford, N. J. has annuonced a red **masking compound** for application to motor parts that are to be kept free of varnishes.

(60) Wagner-Green Company of Cleveland, Ohio, has announced a new type engine hood **heater**, designed to keep important parts under the hood warm on cold nights. . . . (61) Carboloy Company, Inc., Detroit, Mich., has applied high tensile wire to form a "live-spiral" flute on the shank of a carbide masonry **drill**.

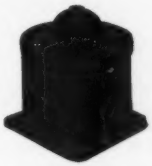
FULLMAN **Latrobe** PRODUCTS

FLOOR BOXES ★ WIRING SPECIALTIES

FULLMAN MANUFACTURING CO. QUALITY LATROBE SUPREMACY LATROBE, PA.

In Design and Performance "Latrobe" Can't Be Beat

Cleanly and compactly designed to cut installation time to the bone and give smooth, trouble-free service "Latrobe" Products give a full measure of value. "Latrobe" Products are proof that the road to true economy lies through quality and quality only.

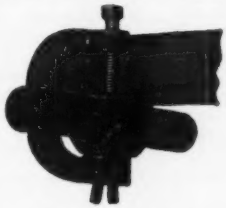


No. 150 Box— No. 207 Nozzle

An adjustable, watertight box for installation in concrete or wood finished concrete floors. Furnished with 4½" Cover Plate #242 and large Adjusting Ring #215.

No. 110 "Latrobe" Watertight Box

Simple and compact in design the No. 110 Non-Adjustable Watertight Floor Box is quick to install and gives trouble-free service. 20A Receptacle. Cover Plate is 3½" diam.



No. 470 "Bull Dog" Pipe or Conduit Hanger

Made of highest grade malleable iron and cadmium plated, the No. 470 is unexcelled for hanging ½", ¾" and 1" pipe or conduit to steel beams up to ⅝" thick. Larger hangers for larger pipe.

No. 252-R Two Gang Box

This No. 252-R Two Gang Box is adjustable and has our No. 208 Receptacle in one section. One Cover Plate has ½" Flush Brass Plug; other has 2" Flush Brass Plug.

1050 Cable Staple for Romex and Non-Metallic Covered Cable

Here is a brand new cable staple designed especially for use with Romex and all non-metallic covered cable. 1½" long by 9/16" wide.

Sold Only Through Wholesalers

"Bull Dog" Insulator Supports

Clamps of high tensile strength for fastening porcelain or glass insulators to exposed steel framework. Four sizes.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

New!
FASCO
10" "CEIL-N-WALL"
KITCHEN VENTILATOR,
Model 1020

FAN UNIT

FAN AND OUTSIDE WALL HOOD ASSEMBLY

For ceiling mounting or in inside wall, directly above stove

- Designed *in collaboration with America's largest builders* . . . for quick, easy, inexpensive installation.
- New FASCO Turbo-Radial propeller, specially engineered for pressure through ducts . . . develops pressure unobtainable with ordinary fan blades . . . three-speed control.
- Unique air intake prevents air re-circulation at inlet.
- Outside wall cap—aluminum . . . rustproof—has built-in balanced louvres. Overhang keeps out rain, drafts, cold.
- Beautifully designed . . . superbly finished . . . priced right.

FASCO wall ventilators are used by America's largest builders . . . 15,000 IN LEVITT HOUSES ALONE! The new FASCO "CEIL-N-WALL" vent will be a leader, too!

WRITE, WIRE or PHONE for complete information. FASCO Industries, Inc., 30 Union St., Rochester 2, N.Y. (Phone HAmilton 1800).

FASCO
INDUSTRIES, INC.
ROCHESTER 2, NEW YORK

Catalogs, Bulletins and Engineering Data

(62) MOTOR CONTROLS, with condensed information, dimensions and prices, are presented in 76-page booklet. Allen-Bradley Co.

(63) SWITCHGEAR and switchgear accessories are discussed with wiring diagrams, photographs, text and specifications in catalog. S & C Electric Company.

(64) STREET LIGHTING for public safety is title of 28-page booklet B4332 discussing safety, basic lighting and planning principles, equipment and installation methods. Westinghouse Electric Corp.

(65) INSULATING materials, including tapes, tubing, sleevings, varnished cloths, mica, papers, wedges, plastics, cordage, varnishes and other products, are described and priced in 128-page catalog 14. Insulation Manufacturers Corp.

(66) PUMP CONTROL by pressure, float and vacuum switches is discussed in bulletin 550 with photographs and specifications. Square D Company.

(67) FLOOR BOXES, their construction, connection and application, is subject of 4-page bulletin 902. Frank Adam Electric Co.

(68) FLEXIBLE CORDS and portable cables are subject of 56-page manual containing complete technical information and dimensional data, diagrams, construction details and application section. Hazard Insulated Wire Works Div. of the Okonite Co.

(69) BATTERY MAINTENANCE for diesel engine cranking service is discussed with emphasis on safety, records, identification, terminal connections, cleaning, ventilation and other important factors. Gould Storage Battery Corp.

(70) MEGGER insulation testers, rectifier and dual-operated models, are pictured, diagramed and discussed in 8-page 2-color bulletin 21-46. James G. Biddle Co.

(71) POWER transformers for small-capacity applications, including single-phase units up to 5000 kva and 3-phase transformers up to 15000 kva, are discussed in 28-page bulletin 61B6084A. Allis-Chalmers.

(72) SOLDER PRE-FORMS is subject of 4-page bulletin arranged to tell all answers connected with pre-formed solder shapes. Soldering Specialties.

(73) LIFT TRUCKS, both mechanical and hydraulic for single and multiple stoke operation with capacities to 7.5 tons, are described in bulletin 26. Lewis-Shepard Products Inc.

(74) FLEX-A-POWER DISTRIBUTION for capacities from 50 to 5000 amps is fully discussed in 40-page catalog TEB-1. Trumbull Electric Mfg. Co.

(75) REMOTE CONTROL WIRING for lighting, outlets and small appliances is discussed with photographs, sketches, wiring diagrams and text. General Electric Co.

(76) SAFETY EQUIPMENT catalog covers respiratory devices, eye protection, hats, gloves, carboy pumps, drum pumps and miscellaneous industrial safety devices. General Scientific Equipment Co.

(77) PRECISION SWITCH, hermetically sealed to guard against the entrance of oil, dust, water or corrosive atmospheres, is subject of file sheet. Micro Switch.

(78) RURAL YOUTH program, including description of 35 pamphlets, booklets and motion pictures available for 4-H electric demonstrations and farm wiring promotional purposes, is discussed in 12-page catalog B-4635. Westinghouse Electric Corp.

(79) DIMMERS for lighting equipment used in lodges are described in pocket-sized pamphlet, with applications for maximum benefits included. Superior Electric Co.

(80) PUMP for sewage and trash use, incorporating a bladeless propeller, is presented with sketches, charts and descriptive text in 16-page 2-color booklet. Fairbanks-Morse & Co.

Coming!

Revolutionary development that will

ROCK the INDUSTRY

FEDERAL NOARK

Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

Custom Tailored

LIGHT

with

POWERSTAT LIGHT DIMMING EQUIPMENT

Whether your auditorium is in a theatre, a school, a church or a hotel, POWERSTAT Light Dimming Equipment "custom tailors" your lighting — gives you the right light for the right occasion — simply and economically.

With POWERSTAT Dimmers in your lighting circuits, you can dim, brighten and blend lights to get the proper effects — to create atmospheres appropriate to the event taking place.

And POWERSTAT Dimmers — motor-driven for remote control by "raise-lower" switches or positioner devices — give you added convenience. The dimmer unit, installed in an out-of-the-way place, can be controlled from one or several locations. You get silent, efficient dimming, brightening and blending of light — plus the convenience of flexible control location.

POWERSTAT Dimmers are offered in a wide range of ratings—for manual or motor-driven control. Write today for descriptive booklets. You'll find it a welcome addition to your file on Lighting Equipment.

FOR DETAILS, WRITE
6030 DEMERS AVENUE
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THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT

POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS

(81) MOTOR SELECTION, explaining difference in fractional horsepower units and the factors to be considered in selecting the right motor for a particular application, is subject of booklet B-3075-C. Westinghouse Electric Corp.

(82) FLUORESCENT lighting for single or continuous installation, using louvers, glass and plastic panels in conjunction with standard 2 or 4-light 40 or 85w lamps, slimline or cold cathode, is discussed in 2-color file sheet with wiring diagrams, photographs and text. Moe Bridges Corp.

(83) TRANSFORMERS for distribution lighting, heating, welding, electric furnace, auto, phase changing, testing, rectifiers and electronics are illustrated and described in Catalog No. TR-50. Eisler Engineers Co., Inc.

(84) SAFETY SWITCHES for high capacity interruptions are explained with drawings diagrams and text in 3-color 6-page folder. Trumbull Electric.

(85) GASOLINE-DRIVEN WELDERS, with specifications for 10 models, pictures and descriptive text, are subject of 4-color pamphlet. Hobart Brothers Co.

(86) MOTOR BULLETIN, GEA 5426, describes tri-clad high-speed synchronous motors with illustrations and application examples. General Elec. Co.

(87) WELDER EXCHANGE plan for factory-built stators, armatures and other parts necessary on welder units, permitting trading of old parts for new, is explained in 6-page folder. The Lincoln Electric Co.

(88) ELECTRIC PLANTS, gasoline-driven, ranging from 260 watts to 35kw in all standard voltages, frequencies and phases, is subject of 2-color 8-page catalog. D. W. Onan & Sons, Inc.

(89) CIRCUITS of 30 amps and less, protected by time-current devices, is subject of bulletin including comparitive operation curves and full description of applications and advantages. Chase-Shawmut Co.

(90) VERTICAL DRILLS for construction work are pictured and explained in 4-page 2-color folder. Salem Tool Co.

(91) CONDUITS and fittings, with comprehensive review of fabrication processes, including sections on sheraduct and economy rigid steel, flexsteel and X-duct junior EMT, are discussed in 30-page catalog 603. National Electric Products Corp.

The New P&S - DESPARD

FLUSH NEON PILOT LIGHT

P&S 1375

RATING:
1/25th Watt, 125 Volts

A PART OF THE P&S-DESPARD LINE

Gives You These Features:

- **A Warning Light, without Heat (Uses a Neon Lamp)**
- **Economy of Operation due to extremely low power consumption**
- **Years of Service *and***
- ***It's Priced Right*—List prices, Brown, 77c — Ivory, 82c**

•

The light source is a 1/25th Watt Neon lamp that will give many thousands of hours of service. Shallow dome is molded of unbreakable, prismatic Plexiglass.

Provides a modern-appearing, flush installation that you will like.

Available through your P&S Distributor.

Send today for catalog information on this new Pilot Light and the complete P&S line of wiring devices.

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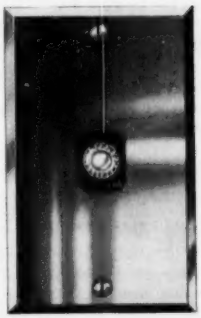
Can Be Installed Singly



or in Combinations with P&S-Despard Switches and/or Outlets.

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Please send information on your complete line

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Please print plainly

There is NO SUCH THING as an "RLM TYPE" Lighting Unit!

Either it is RLM CERTIFIED or it is NOT.
The Only Way To Be Sure Is To

SEE the RLM LABEL!

Looks can be deceiving in lighting units, too! A lighting unit may LOOK like an RLM Unit, it may have a similar outward appearance, contour, shielding angle, etc.—but unless it is made in accordance with RLM Standard Specifications and carries the RLM Label, it is *not* an RLM Lighting Unit. There is no such thing as an "RLM Type" that does not have the label.

Why No "RLM TYPE"? The RLM Label on fluorescent and incandescent lighting units, not only assures the buyer of design and construction that meets certain minimum standards*, but also provides him with a WARRANTY of UNIFORM QUALITY.

Only those products of lighting manufacturers which are *consistently proved* to be of *uniform quality* and meet the published specifications of the Institute are permitted to bear the RLM Label. This uniformity of quality is of exceptional importance to all those who buy, use, specify, recommend or sell lighting equipment. It is essential to uniformly satisfactory lighting equipment performance, that each unit in the system perform with equal efficiency to the other . . . that ballasts function with uniform efficiency . . . that the reflection factor be uniform from unit to unit . . . that the units be of uniformly durable construction with the identical-gauge steel and the same thickness Porcelain Enamel. Such uniformity reduces to a minimum the plague of spotty performance by individual units in a lighting system.

How RLM Checks Uniformity of Quality

According to the RLM testing and inspection procedures, representatives of the Electrical Testing Laboratories periodically visit plants of all RLM member-manufacturers. They take lighting units right off the assembly lines and out of stock for testing and inspection at their laboratories. They may also obtain test samples directly from the distributors' shelves or out of contractors' stocks in order to check Uniform Quality at every level of distribution.

This activity of the RLM Standards Institute, which makes possible the Warranty of Uniform Quality, is not duplicated by any other agency in the lighting industry. That is why there is no such thing as an "RLM Type" Lighting Unit.

FREE SPECIFICATIONS BOOKLET! This

up-to-date 36-page booklet tells why it is important to SEE THE RLM LABEL before buying or specifying lighting units. It contains all RLM Specifications, covering vital construction and performance factors that should have major consideration by the buyers and specifiers. It is an indispensable help in the sale of industrial lighting units. For your complimentary copy (or copies), sent without obligation, write:

RLM Standards Institute,
Suite 819, 326 West Madison St., Chicago 6, Illinois.

This Advertisement is published in the interest of the Entire Lighting Industry by

RLM STANDARDS INSTITUTE
INCORPORATED

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

*Every RLM Unit Must Conform with Certain Minimum Standards such as these:

Porcelain Enamel Reflectors — all RLM Units must have a specified thickness of Genuine Porcelain Enamel fused to steel. This unsurpassed high-reflection, high-diffusion reflecting surface is the only commercially available finish that cannot deteriorate or corrode. Simple soap-and-water cleaning quickly restores it to original efficiency.

High-Quality Ballasts — RLM Fluorescent Units must be equipped with Certified Ballasts which prevent high-temperature ballast operations, supply proper starting current and maintain proper operating watts to the lamp. Because of their high power factor, present wiring capacity can be utilized most efficiently.

Reflector Design — every RLM Unit must conform with the most accepted principles of Illuminating Engineering. Such design protects the workers' eyes while delivering, not only the most light per dollar, but also the required quality of light for the individual seeing task.

Sound Construction — RLM Units must comply with high fabrication and materials to insure standards of maximum resistance to sag, distortion and breakage.

R-4057

QUESTIONS from readers on problems of industrial equipment, installation maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Regulator

QUESTION 341—Seeking perfect stable voltage, we placed a constant voltage transformer in series with an electronic (tube type) voltage regulator and ended up with a far more varying voltage than we obtained with either one alone. Can anyone account for this? Both regulators are in perfect condition.—L.R.D.

A. TO QUESTION 341—I believe Mr. L. R. D. would be better off with only one regulator, preferably the transformer type.

He does not state what type of electronic regulator he is using, or the type of load. Very often in planning constant voltage systems, the question of wave form is neglected. In this particular case, this is apparently the fundamental trouble. A graphical representation of voltage states that e = Em sin. wt. Where e is effective voltage or voltage read on a voltmeter, Em is maximum voltage and sin wt is angular velocity depending upon wave form and frequency.

The sine wave is dependent upon its odd harmonics to produce a true wave, especially the third harmonic. Most constant voltage transformers are dependent upon a high degree of saturation, or variation in power factor which keeps the third harmonic high and distorts the wave form. This third harmonic might have a maximum voltage of nearly twice the effective voltage. It will also change with type of load. Since the effective voltage is directly dependent upon E max, any variation in harmonics changes the final voltage in nearly direct proportion.

Taking into consideration the type of wave form, which at best is not good, being put into the electronic regulator, we note that there is a very good possibility of the electronic regulator working on harmonic of the output of the transformer regulator and giving poor results. If we take the output of the transformer regulator as a whole, we would probably note a fair R.M.S. or summed up voltage. The third harmonic voltage while not large in power, is high in voltage and would not be noticed too much. Another source of trouble could be in the action of the electronic regulator picking up both odd and even harmonics which would net an even more distorted wave form.

I feel that Mr. L. R. D. should use only one regulator, and if the generated voltage has a good wave form, he should obtain good results.—J.E.C.

A. TO QUESTION 341—I believe the trouble is caused by the introduction of harmonics by the voltage regulator equipment. It may be these harmonics are amplified and aggravated by the combination of the two regulators in series. The harmonic voltages will vary considerably with load.

One thing to watch in checking regulators is the type of voltmeter used. Because of the harmonics, the output is no longer a sine wave and this must be recognized in the selection of a meter. A rectifier type meter should not be used as they read correctly only when measuring sine waves.—R.J.S.

A. TO QUESTION 341—Voltage regulators work on the principle of waiting until a voltage change develops before they can take care of the change. When we use a slow speed regulator on the load side, and a high speed regulator on the line side, then the slow speed regulator will not work because the voltage will be constant as far as the slow speed regulator is concerned. If we reverse them, then both regulators will insist on getting the correct voltage on their output side. For perfect stable voltage, I will suggest a motor generator set in order to use the inertia of the motor generator set to bridge short time voltage changes. For long time voltage changes, use a standard voltage regulator.—H.S.

Motor Protection

QUESTION 342—We have experienced a considerable number of failures in 110 volt, 60 cycle, single phase motors of the split phase type in which the starting windings are burned out due to mechanical wear of the starting switch. These motors have been protected only by the usual 15 amp. fuse on the branch circuit which apparently is heavy enough to cause the coils to burn out.

We have considered the use of Klixon protectors, fusestats and switches with heat coils. What is the most practical type of protection for these motors which have not had it applied at the factory?—W.D.R.

A. TO QUESTION 342—For protecting your small split phase type induction motors, I have found success using "Fusestats".

The trick in using Fusestats is to obtain the smallest rating that will allow the motor to function and this generally has to be done by trial though computation gives you a starting reference point.

If your switch holds in the starting winding of the motor draws more current. If this continues, your Fusestat is bound to function.

I have used Fusestats at full load and as much less as possible of the full load rating—the characteristic lag allows the motor to get up to speed normally without kicking out. Should the switch stay in, my experience is that the fuse kicks out before any damage is done to starting winding.—E.A.M.

A. TO QUESTION 342—Your problem has been the cause of many of these ¼ hp. single phase split-phase 110 volt motor to burn their starting winding.

Nothing much could be done in the beginning, other than to maintain a system whereby the motor had to be checked often, and checked whenever the operator of the machine, where this motor would be mounted, would complain of the erratic starting condition.

Then, we would be on hand, to make the necessary repairs. However, some of these motors have had a thermal relay installed where the complete motor connection has been under the protection of this thermal. This thermal is so set that the motor will not start unless someone in authority has

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checked this motor and reset the thermal, after having given its O.K. to use the motor. However, this thermal, plus the system of rechecking and proper fuses for each of these motors we were able to eliminate about 80% of the usual troubles.—O.C.

A. TO QUESTION 342—Fractional hp. split-phase motors are not protected against overload by the usual 15 amp. fuse in the branch circuit. Fuses must be of this size, however, in order to hold the starting currents of these motors. Refrigerator motors have been protected successfully for many years by controls having thermal protection, with the heater coils of the correct size for the particular motor involved. Refrigerator motors also often failed due to mechanical wear of the starting switch, as well as worn bearings, but seldom burn out. Switches with built in thermal overload protection, with changeable heater coils should give the most practical type of protection.—J.R.

A. TO QUESTION 342—The trouble that you are experiencing is quite a common occurrence wherever split phase motors are used. The writer has had considerable experience with this complaint in the last ten years. Motors of this type are usually used in out of the way places and are not commonly closely observed, since they are used mostly to drive fans, blowers, low velocity pumps, etc. In almost every case the writer has found that the circuit fuse will fail to give adequate protection. Klixon type protectors are excellent but are not readily adaptable to most motors or to most installations. Since they are thermal devices, these protectors have to be within thermal conducting contact of the winding itself or the motor laminations. Therefore, in many cases a device of this type will be impractical to install or to adapt to a given motor. Another disadvantage is also evident. The exact thermal rating will have to be determined for each motor involved. This will be a very arduous task.

Switches of the type using replaceable heating coils are excellent for protection against coil burn-outs. The only disadvantage here will be the rather high initial cost of the original installation and the subsequent maintenance expense. In most every case the existing motor control circuit would have to be altered and rearranged. The cheapest and most adequate method would be to install type S, T or W fusetrons in the motor supply circuit. In many cases, this may only require the substitution of the protective devices for the existing fuses. In other cases it may be more convenient

to install an insulated cartridge fuse block on the motor terminal box cover and to use the cartridge type fusetron, type W. The terminal boxes of some motors may not permit this, however. In such cases it may be more advisable to use the following method: insert a ½" close nipple in the terminal box knock-out, using a regular bushing and lock nut, then install a three inch steel box on this nipple with another lock nut and bushing, then install a common porcelain light socket on the cover of the three inch box, insert in the socket a type T or a type S (with tamper-proof adapter) fusetron in the socket, and then wire in circuit in the same manner as a fuse.

You will find that it is usually practical to use a fusetron with a rating of 20 to 25 percent higher than the nameplate rating of the motor in amperes. In some cases, it may be practical to use a fusetron with a rating as close as 10 percent higher than the current rating of the motor.

In every case within the writer's experience the fusetron has protected the motor windings satisfactorily. In many cases, the fusetrons have protected the motors from damage when the trouble has resulted from dry or worn bearings or even from excessively tight belts. Both the initial costs and the maintenance costs have been exceedingly small.—H.T.O.

A. TO QUESTION 342—The Fusestat provides one of the most convenient means of protecting 110 volt, 60 volt single phase motors from damage to the starting winding caused by mechanical wear of the starting switch.

Complete electrical protection can be obtained by mounting the Fusestat in the panel box if a single motor is connected to a particular circuit. If more than one motor is connected to any one circuit, it is necessary to mount the Fusestat in the switch at the motor so that the individual protection is obtained.

Once the proper size Fusestat is selected, the adapter for it can be screwed into the standard Edison base cutout in the panel box or switch and then it is impossible to use a Fusestat of larger rating, thereby destroying the protection.

If thermal as well as electrical protection of the motor is desired, the Fusestat can be mounted directly on the motor frame by means of special receptacles available. A Fusestat so mounted will open because of the heat generated in the motor itself, as well as due to the current flowing through the Fusestat. Hence, if the motor tends to overheat because of high ambient conditions or slightly worn bearings or clogged ventilating slots, the

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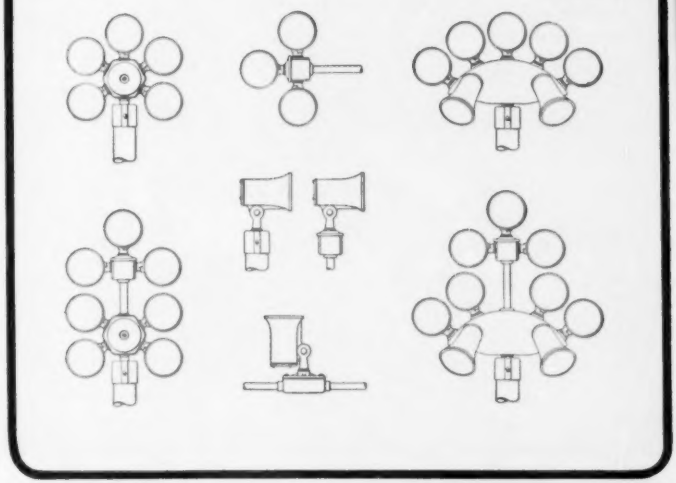

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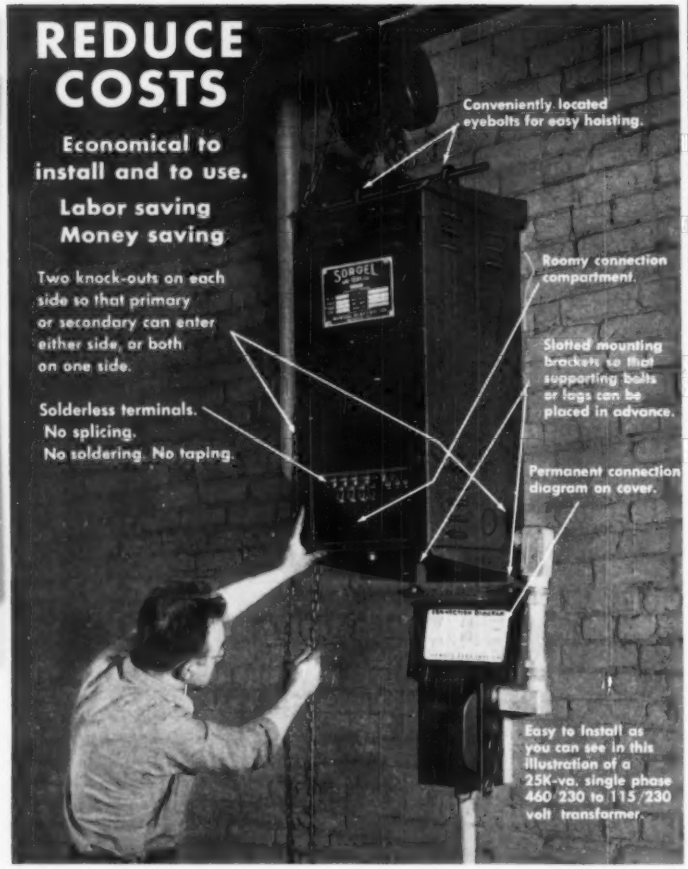
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Fusestat will open shutting down the motor before the windings reach a dangerous temperature. Obviously, if the Fusestat is mounted in the fuse panel or switch, this double protection is not possible. However, the Fusestat in the panelboard or switch will give complete electrical protection to the motor at a minimum cost.

A fuse manufacturer has available charts showing the proper size Fusestat to use to protect 110 volt, 60 cycle single phase motors, as well as descriptive information on the various type of receptacles available.—J.C.L.

A. TO QUESTION 342—A small single phase motor will burn out its starting winding if it is not disconnected from the circuit when stalled or if the centrifugal switch does not open the starting winding circuit. An ordinary single element fuse will not protect the starting winding because the very small wire with which it is wound will be destroyed before the fuse blows. But if we use a small enough fuse to protect the winding, it will not allow the great amount of current to flow that is needed to start the motor. A dual element fuse such as a Fusestat or Fusetron will do this. This type of over current device will start the motor without blowing, because of its inherent delayed action or lag. The Fusetron should be rated about 115% of nameplate current and will adequately protect a single phase motor against overloads and eliminate starting winding burnouts. This is about the simplest device to use for this purpose. All that is needed is a suitable cutout block in which to mount it.—H.C.S.

A. TO QUESTION 342—In regard to the matter of selecting the right type of protection for your 110 volt 60 cycle single phase split phase motors, I would like to suggest that these motors be equipped with Klixon protectors even though they were not standard equipment at the factory at the time these motors were purchased. I base my decision in this matter on the following reasons: First, they can be easily reset after the fault has been cleared, causing the protector to trip. Secondly, you would have no parts to replace as these protectors depend primarily on bi-metallic action and last but not least, in fact the most important reason for these protectors is their *Fast Tripping Action!* Now we come to another phase on this problem and one that hits close to home as so to say and that is the *Cost*. These protectors undoubtedly will cost slightly more than the other two forms of protection, but the results obtained will more than make up for this in

practically no motor burnouts to speak of: Heat causes the temperature of the motor to rise rapidly to the point of burning out your starting windings. With protectors, after the temperature has passed a certain point, this protector goes to work and fast to protect your motors from damage to the starting windings and thereby save you on repair bills.—L.C.D.

Can you ANSWER these QUESTIONS

QUESTION H16—An alarm horn is installed to sound an alarm when any one of several contacts close. Alarm closes a small 2 pole relay, one pole lighting an amber light for that particular alarm contact and the other pole connected in parallel with several other similar relays operated from other alarm contacts, so that the horn will sound when any one of the alarm contacts closes. A switch is installed in series with the horn so that it will be used to cut out the horn until the trouble is cleared. It is then supposed to be reclosed, but quite often no one thinks about closing the switch, with the result that the alarm horn is of no benefit. I would like to know how the alarm system may be connected so that, if possible, the horn can be cut out by some means when desired, but that the system will automatically reset when the alarm contact opens and the amber light goes out, so that the alarm horn is ready for the next operation without any further attention.—C.B.T.

QUESTION J16 — What determines speed of a d-c motor? We have both 2 and 4 pole machines running 1800 and similarly 3500 rpm. Will some reader please explain how this is determined? —L. G. D.

QUESTION K16 — Can someone suggest a way to test selenium rectifier stacks? I've tried measuring the resistance of the rectifier stack with an ohmmeter, which gives me no satisfactory results.—G. K.

QUESTION L16—Several belted machines in the plant have been found with pitted bearings. Some were motors; some were other equipment. The first thought was that the pitted condition was due to corrosion, but someone said it was probably due to electricity on the rotating parts. Please give more information about what is probably happening and what can be done to correct the trouble.—L.R.B.

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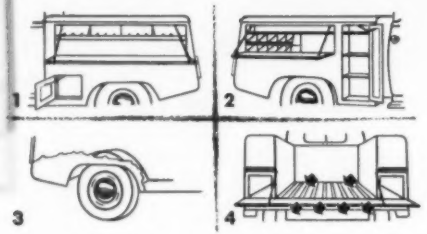

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Questions on the Code

Grounding

Q. *Wiring specifications on a machine shop in an all metal quonset type building, 100 by 40 feet, call for four one inch ground rods to be driven to a depth of 10 feet, one at each corner of the building. This small plant is out in the country so there are no water mains to ground to. Can these rods be used to ground the building against damage by lightning and also as the neutral ground for the service equipment?*—F.A.F.

A. Under Section 2582 of the N. E. Code you will find permission to use the metal frame of an effectively grounded metal building frame as the neutral electrode where a continuous metallic underground water piping system is not available as the grounding electrode. Therefore in your case the question remains as to whether or not the building frame is effectively grounded. Section 2584 requires resistance to earth to be less than 25 ohms, so if an instrument test indicates this limitation is complied with, you would be complying with the Code if you ground the neutral to one of these rods or to the building frame. It is assumed you know that Section 2586 prohibits the use of regular lightning ground rods used to ground lightning rod installations as neutral grounds. However, in the case you refer to this building is not equipped with lightning rods but for protection the owners desired the grounding of the building frame and sheathing. It may also be well to call your attention to the fact that a ground having a resistance of 20 to 25 ohms will not open the smaller overcurrent protective devices in the event of an electrical fault. In fact, for 15 ampere protected circuits the resistance to ground should not exceed about 5 ohms if adequate protection is desired.—G.R.

Conductors

Q. *Does the Code prohibit the use of conductors in multiple in all sizes, No. 1 or smaller, and if so, why? On many jobs where it is necessary to increase service capacity this rule, if enforced, adds considerably to the cost of such a job.*—E.L.D.

A. The Code under Section 3105 states that conductors may be run in multiple in sizes 1/0 to 500,000 c.m. This is further restricted by limiting the number of conductors which may be run in multiple as follows: Not more than 3 No. 1/0 or four 2/0 or five 3/0 to 500,000 c.m. Then realizing that there will be instances when compliance to these provisions may not be practical, the Code states that if special permission is obtained from the official having jurisdiction, other sizes or more conductors may be so run. This restriction is felt necessary to assure the use only of conductors of the same size and length. Therefore you should consult with your inspector the next time you are concerned with an increase in service capacity and if conditions warrant, he no doubt will grant permission to multiple conductors of other sizes.—G.R.

Service Disconnects

Q. *The sketch below is of a proposed service installation and I would like to know if it would meet Code requirements in respect to Sec. 2351 General, and Sub-paragraph a, on Disconnecting Means.*

You will note that I have not included a master disconnect switch but am using individual switches on each tap of which there are six. Am I right or wrong on my theory?

The service conductors are fed through the current transformer cabinet without reduction in size and taps are taken off in the wireway for each respective load.—S.M.K.

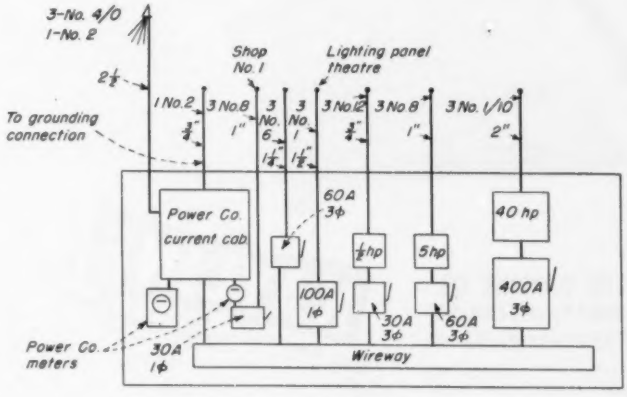
A. The layout as shown in the sketch satisfies rules 2351 General, and sub-paragraph 2351b inasmuch as there are not more than six service switches in the group of separate enclosures at the same location.

The size of the service conductors however, should be carefully checked as the 40 hp three phase motor would require a feeder capacity of 130 amperes. This would leave only 65 amperes of feeder capacity in the No. 4/0 service conductors (195 minus 130 equals 65 amps) while the theatre lighting panel feeder alone apparently needs a feeder load of 100 amps.—F.N.M.S.

Fixture Circuit Loading

Q. *Is it permissible to permit three slimline fixtures with four 75 watt lamps each on a 15 amp 115 volt circuit?*

The total wattage for each fixture is 380 watts maximum, having two 2-lamp ballasts in each fixture.—T.M.



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A. In general a 15 amp circuit may have a maximum load of 15 amps. The wattage of such a circuit on 115 volts, would be 1725 watts (115 volt times 15 amps equals 1725 watts). As these are slimline fixtures however, they are evidently not in a residential occupancy but would be in a location where they are in "continuous operation" and on such a circuit, the load should not exceed 80 percent of the above maximum, or, in this case, not over 1380 watts.

Inasmuch as the maximum wattage of each of these fixtures is given as 380 watts, the load with three on a circuit would be 1140 watts. This is, of course, less than the 80 percent limit of 1380 watts and therefore is permissible on a 15 amp branch circuit.—F.N.M.S.

Wiring a Paint Dipping Room

Q. *Bids have been called for the wiring of a paint dipping room, and all the specifications ask for is compliance with the Code and at least 25 footcandles of illumination. One of my men has suggested we call in the local inspector and ask him if he will O.K. the use of ordinary lighting fixtures if we provide a ventilating system that is electrically interlocked with the lighting and power in this room as the cost of sufficient explosion-proof fixtures to assure 25 footcandles will be tremendous. Will the Code permit such an arrangement?*—B.K.

A. Yes, the Code will permit such an installation providing you furnish sufficient evidence to your inspection authority to convince him your plan is sound. The N. E. Code under Section 5001 reads as follows:

"The provisions of this article apply to locations in which the authority enforcing this code judges the apparatus and wiring to be subject to the conditions indicated by the following classifications. It is intended that each room, section or area (including motor and generator rooms and rooms for the enclosure of control equipment) shall be considered individually in determining its classification."

Therefore it is the duty of the inspection authority to decide whether or not the room, area or section shall be considered as hazardous. In a paint dipping operation the amount of solvent vapors which will be liberated may readily be determined. Handbooks available to everyone show the explosive ranges of the various solvent vapors and we know the average petroleum base solvent is such that a pint,

when evaporated, will make 350 cubic feet of air most explosive. Assuming a safety factor of at least four and moving 1700 cubic feet or more of air from the room, section or area for each pint of solvent evaporated will prohibit the formation of an explosive air vapor mixture providing the ventilating system is properly designed so it will remove the vapors from the building. There are several factors to be considered the most important of which is the fact that as yet all solvent vapors are heavier than air making it necessary to have all air discharge openings at or in the floor. Then the system must be designed to prevent air pockets in the room corners, and the floor must be without pits or depressions that are not vented.

There are a number of installations such as this now in operation and the experience is excellent. When one considers the fact explosive vapors may be ignited from any source, it seems much more practical to use an interlocked ventilating system than to use an explosion-proof electrical installation and then have a static or friction spark cause an explosion. I personally believe every inspector should insist that the electrical interlock be so arranged that no circuit could ever be energized within such an area, room or section until the ventilating system was in operation and that in the event slow drying finishes were used the fan or fans should be controlled by time clocks to operate for whatever time is found necessary following completion of the day's operation.—G.R.

Branch Circuit From a Three Phase Four Wire System

Q. *On a three phase four wire 120/208 volt grounded neutral system, should two single phase circuits be taken off with one common neutral or with two neutrals? It seems to me that a common neutral for two single phase circuits is not really a neutral because it is not the midpoint of 208 volts. What is the Code on this?*—F.G.

A. A three wire 120/208 volt branch cricuit may be tapped from a three phase four wire 120/208 volt grounded neutral system. Equipment connected to each side of this three wire circuit would be connected between either of the phase wires and the (common) grounded neutral. A neutral conductor for such a three wire branch circuit need not be larger than the phase wires as it will not be sub-

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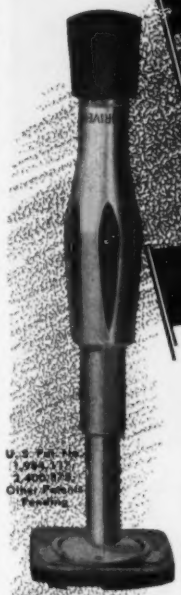

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The formula for Good Lighting is the combination of proper equipment and simple methods of maintenance. The Abolite Duo-Move System encourages regular cleaning habits because Duo-Move units can be cleaned and relamped quickly and safely without using clumsy ladders. Merely a twist of the wrist—reflector and lamp assembly can be removed and serviced—another turn and it's back in position . . . no interruption to workers . . . no lost time. The Abolite Duo-Move System guarantees maximum illumination with minimum service expense. Write for the Duo-Move story today!

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ABOLITE Lighting

jected to more current than the phase wire.

A three wire 120/208 volt feeder or sub-feeder could also be taken off of a three phase four wire 120/208 volt grounded neutral system.—F.N.M.S.

Voltage Drop on Buried Wires

Q. *This refers to the Question and Answer on "Protection for Barn Feeders" in the December 1949 issue of your magazine. In the last paragraph of your answer you state "Otherwise, only a small amount of current might reach the Barn" and you advise keeping the wires close together in order to get current at the barn. Is this to be interpreted that if the wires are not spaced close together, there will be an excessive voltage drop and therefore little current at the barn? I am rather confused on this statement and would appreciate further explanation.* —J.H.C.

A. Yes, separating the wires from each other when they are buried under ground directly in the earth, would result in excessive voltage drop because of the magnetic field between and surrounding the wires. This effect would be increased by the presence of magnetic material (such as iron), in the soil.—F.N.M.S.

Official NEC Interpretations

INTERPRETATION No. 344
Issued November 28, 1949
Section 3543
Underfloor Raceways

QUESTION: Was it the intent of the 1949 supplementary revision, section 3543-a of the National Electrical Code, to disallow the permission of the 1947 Code, section 3543-c, namely:

"Metal flat-top raceways in office occupancies and not over 4 inches in width used for signal and communication systems and metal flat-top raceways not over 2 inches in width used for power and lighting circuits, may be laid flush with the concrete if covered with substantial linoleum not less than ⅛ inch in thickness or with equivalent floor covering. Where both of these raceways are to be installed contiguous to each other the raceways should be spot welded together so as to form a double raceway,"?

ANSWER: No, the intent was to eliminate a conflict observed in the provisions of sections 3542 and 3543-c, so that conductors for light and power circuits could be run in ducts 4-inches wide, if desired. No violation need be recognized when provisions of former

paragraph "c" of section 3543 (not deleted from the Code) are satisfied.

INTERPRETATION No. 345
Issued November 28, 1949
Section 3381-3382
Use of Service Entrance Cable.

STATEMENT: A multiple occupancy building is supplied through a bank of meters in a single enclosure mounted outside on the building wall. Sub-sets of service entrance conductors supply the individual occupancies, each of which has the required disconnecting means.

QUESTION 1: Does section 3381 recognize the use of service entrance cable for these sub-sets of service entrance conductors?

ANSWER: Yes.

QUESTION 2: Does section 3382 forbid the use of a grounded conductor without individual insulation in a service entrance cable assembly under the foregoing conditions?

ANSWER: No.

INTERPRETATION No. 346
Issued December 8, 1949
Section 93101
Use of Type AVB Switch Board Wires

QUESTION: Is it the intent of the National Electrical Code that Type AVB asbestos and varnished cambric insulated conductors having one varnished cloth and one asbestos "ply" in its built-up insulating covering be recognized for general use when pulled into raceways in dry places?

ANSWER: No; the intent of the words "switch-board wiring" in the fifth column of paragraph "e" of section 93101 is to limit this construction as indicated. For installation in raceways in dry places, Type AVB wire should have a second "ply" of asbestos in its insulated covering, making 3 plies in all two of asbestos and a center ply of varnished cloth.

MERITS OF ***transformer vault drainage techniques are aired by Al Karl, (left), chief electrical inspector, Kansas City, Kansas; and W. D. Roach, Electrical Clearing House, Louisville, Kentucky.***

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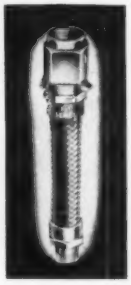

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Industrial Electrification

Arc Welding—Safely Speaking

Proper care of equipment and circuits, basic rules for personnel protection and fire prevention, the application of NEMA standards and common sense can eliminate hazards from industrial electric arc welding practice.

By W. W. Reddie
Welding Department
Westinghouse Electric Corporation
Buffalo, New York

This article concerns itself only with electric arc welding—not with gas welding or cutting. It deals practically with safe practices contributing to the elimination of accidents.

Arc welding is not essentially a hazardous process but, when recommended practices are neglected, accidents can and will happen.

First, consider the welders. Dc welders consist of a generator with ampere and voltage characteristics suitable for arc initiation and maintenance, driven by a motor or, for locations where electric power is not available, by an engine, either gasoline or diesel.

Ac welders are of the two winding air cooled transformer type with secondary (output) characteristics suitable for initiating and maintaining the arc.

These machines are subject to extremely hard usage both indoors and outdoors; rarely receiving expert attention. And many installations call for portable machines that may readily be moved about on their own running gear without the use of cranes. Consequently, unusually rugged construction with relatively light weight is required. NEMA standards cover established practice in ratings, basis of rating, methods of test and broad overall principles of construction contributing to safety.

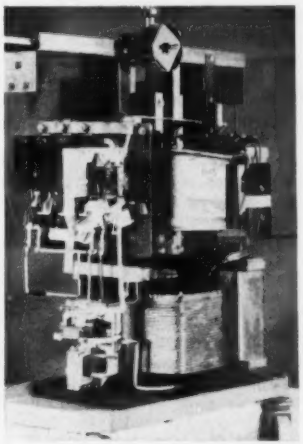
In addition to following recognized NEMA standard practices, the manufacturer can do a great deal to contribute to safe operation of the equipment through careful attention to details of construction, such as terminal markings, enclosures, internal wiring and wiring details.

These details are important for two reasons. The welding operator is exposed to the voltage on the output side of the machine, and every effort should be made by the manufacturer to foresee and eliminate any possibility of primary wiring coming in contact with secondary wiring under accidental conditions. Secondly, these details are important to safe maintenance operations.

Usually, in industrial practice, the primary or source of power wiring gets the most attention. In welding operations, the welding circuit, output side of the machine, is equally important and this subject is therefore considered along with the general subject of installation.

The 1947 edition of the National Electrical Code for the first time covers the proper installation procedures for both direct current motor driven and transformer type ac welders.

These provisions in the Code recognize that arc welding is a duty cycle and not a continuous load and provide for selection of primary supply conductor feeding groups of welders on this basis, thus leading to savings in the amount of copper required for the primary circuits.



AUTOMATIC OPEN CIRCUIT ***voltage control on ac welder consists of contactor and relay. Voltage is automatically reduced to 30 volts when arc is broken.***

It has been standard practice, over a period of years, to use magnetic starters rated in amperes instead of horsepower for starting the motors on motor-driven dc welders and the Code now recognizes this practice.

Practice on primary breakers at the welder has varied in the case of ac welders. In most cases, welders, which are considered primarily for portable service, ratings below 300 amperes, were supplied with a switch or circuit breaker mounted on the welder. The Code now requires that a switch rated in horsepower or a circuit breaker be installed in the primary connection of the welder unless it is supplied as part of the welder.

In none of these cases does the motor starter, switch or circuit breaker mounted on or at the welder provide protection for the power supply circuit, and the Code requires proper circuit protection.

In addition, it should be kept in mind that any device mounted on an ac welder should be capable of opening the circuit under any conditions of load. Contactors are not in general use because they are not circuit breakers. The Code covers the proper selection of breakers or switches for the duty required.

Provision must be made in all cases, either ac or dc machines, for grounding the frame or case of the welder, in order to protect the operator against the possibility of exposure to the power supply voltage due to possible breakdown of insulation in the machine. Although this is improbable in modern machines, this safety measure should always be observed.

Grounding of the frames is quite

easy in machines permanently installed, but in portable machines, it can be easily overlooked. The use of multi-conductor primary cables is recommended. In the case of the small portable single-phase ac welders, an Underwriters approved primary cable with 2 power conductors and 1 ground conductor complete with primary fittings is usually supplied as a part of the machine. Attention is especially called to the practice which should always be followed in the installation of groups of single-phase transformer type welders on single-phase or polyphase systems.

Usually the electrical engineer thinks first of balancing the load on a polyphase system. Although most modern ac welders have open circuit voltages within the maximum 80 volts recommended in the NEMA Standards, indiscriminate connecting of these welders can result in combinations of voltages which under possible, even if remote, circumstances could expose the operator to a considerably higher open circuit voltage. The American War Standard on Safety in Electric and Gas Welding and Cutting Operations contains explicit instructions on how to handle this problem.

To illustrate this point, consider two dc welding generators, one set up for straight polarity work (holder negative) and the other set up for reverse polarity work (holder positive). The open circuit voltages in this case would be additive. Assuming the "work" terminals of these two welders to be grounded as in normal practice, a person coming in contact simultaneously with uninsulated parts of the electrode terminals, cables, or holders would complete the circuit and be subjected to the sum of the individual voltages of the two machines, say 160 volts in the case of machines having open-circuit voltages of 80 volts.

If ac welders are not properly phased, similar freak conditions can exist and these can readily be avoided by following the methods of grouping the welders recommended in the Code referred to.

The welding circuit, consisting of welding service cable for the electrode lead and work lead, electrode holder, ground clamps and connectors for providing extensions to the leads are included under the subject of installation.

These parts are all subject to hard usage and abuse, and, over a period of years, have been highly developed to meet both service and safety requirements.

When welding lead cable extensions are necessary, substantial insulated connectors of the locking type should be used.

The work lead (cable) is the most satisfactory means of providing the return circuit (ground) from the work to the welder. Some operating conditions may require using a steel structure or pipe line for the return circuit. Under such circumstances, precautions must be taken against creating unsafe conditions, such as bonding the joints and making sure that no conditions of electrolysis or fire exists.

Pipes carrying gases, flammable liquids, or electrical conductors, should never be used for ground returns.

Pipes or structures used for ground returns should have all joints checked to make sure there is no sparking or heating that could constitute a fire hazard. Joints should be bonded if such structures are to be permanently used, and periodic inspections should be made to insure that no condition of electrolysis or fire hazard exists due to using these structures as conductors.

Classes of Holders

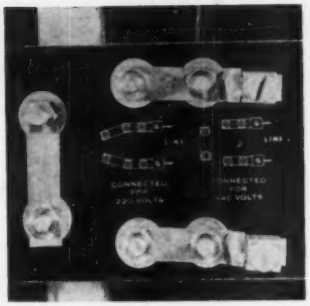
Electrode holders of many individual design types are available for the whole range of welding work from the lightest to the heaviest classes. These holders broadly fall into two classes, holders which are fully insulated and those which are insulated except for the electrode gripping jaws.

The insulated jaw holders were originally developed to protect the work from marring due to accidental contact or to provide some protection against accidentally leaving a bare holder in contact with the work, rather than to afford additional operator protection against shock.

Many bare jaw holders are still used but the trend is toward the fully insulated type. The fully insulated type should always be used with ac welders, as, if properly made, it will afford additional operator protection. Care should be taken to make sure that fully insulated holders do not have exposed screw heads on any portion of the holder that might come in contact with the operator.

Where service conditions permit, a continuous length of cable should be used from the holder to the machine, thus avoiding joints which if not well insulated could come in contact with the operator. This is usually satisfactory if lengths do not exceed 35 feet and a good grade of extra flexible welding cable is used. In no case should cable splices be permitted within ten feet of the holder.

It seems almost elemental to repeat that, in the case of portable welders, either large or small, care should be taken to see that primary supply cables are kept free of the welding leads, and that welding leads on all welding machines, portable or stationary, are kept in order and so placed as not to tangle with the operator, other people or other objects near the welding op-



TERMINAL MARKINGS ***on primary terminal board of ac welder are clear and concise, aiding accurate reconnection. Only competent persons should be authorized to change connection.***

FAN GUARD ***on inside of blades promote safety to persons making adjustments or repairs to gasoline engine-driven welder.***

ELECTRODE AND WORK LEADS ***made up with continuous cable runs from fully insulated electrode holder on the electrode lead and work connection lug on the work lead are safety recommendations.***

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2. Running overcurrent protection to prevent motor from operating at damaging temperatures.

Now you can match your overload protection for motors under starting and locked rotor conditions as well as under running conditions. Allen-Bradley starters now have interchangeable overload relay spindles to provide various tripping characteristics. The proper spindle gives your motor locked rotor and starting protection. The proper heater element gives running protection. Unnecessary shutdowns will then be eliminated.

1 Interchangeable Relay Spindles

for Starting Cycle Protection

GREEN SPINDLE—For motors with low locked rotor current or short allowable locked rotor time.

RED SPINDLE—For motors with normal allowable locked rotor time and normal starting time.

TAN SPINDLE—For motors with normal allowable locked rotor time and long starting time. Ideal for flywheel and other high inertia loads.

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These heater elements, which carry the main motor current, are selected to match the rating of the motor. Allen-Bradley supplies 61 heater sizes to provide adequate coverage of all motor ratings.

These heaters, when used in conjunction with the three types of spindles illustrated at left, provide 183 combinations to match the characteristics of your motors.

That's why Allen-Bradley motor starters provide full motor protection.

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HOW *Interchangeable Spindles and Heater Elements provide* TWO WAY MOTOR PROTECTION on Allen-Bradley Starters

MOST overload relays protect motor windings during the running cycle. But, because motors and motor loads vary so much in character, an overload relay with a single characteristic is unable to provide full motor output and protection under starting and locked rotor conditions.

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If you will give Allen-Bradley engineers complete information on your starting cycle, normal running current, frequency of starting, and ambient temperatures, they will supply the correct combination of heater unit and relay spindle assembly to fit your motor and load condition.

As a result, it will be possible to keep your motor running at a safe operating temperature during starting, running, and locked rotor conditions—adding years of motor life. Now you can work motors safely to full capacity—eliminating unnecessary, costly shutdowns. Write for full information.

OTHER ALLEN-BRADLEY OVERLOAD RELAYS

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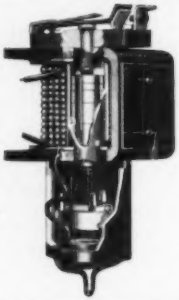
Resets quickly after tripping. Ideal for woodworking and other equipment where motors frequently stall. Trip current and tripping times adjustable. Silicone dashpot fluid practically eliminates changes in tripping time with temperature.



BULLETIN 820
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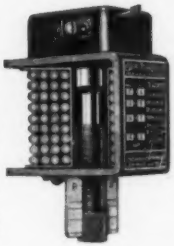
For accurate overload protection of slip ring and squirrel cage motors having normal allowable locked rotor times and locked rotor currents five or more times full load current. Tripping value easily adjusted over wide range.



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SOLENOID MOTOR CONTROL
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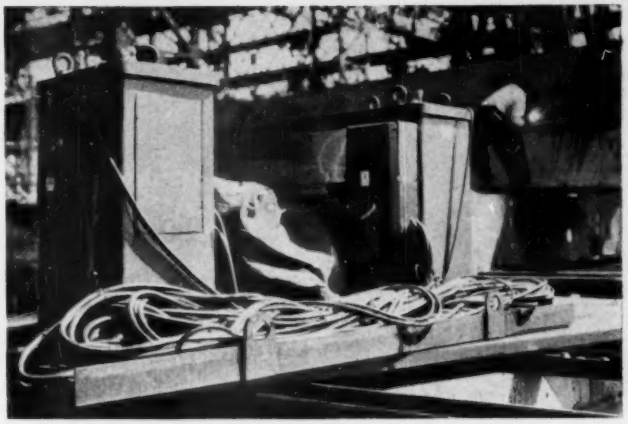
erations; yet failure to observe these simple rules can and does lead to serious or even fatal accidents.

The arc welding process is based on the use of an electrical machine to produce an electric arc, the heat of which is ued to fuse metal parts together. High intensity heat is produced at a rapid rate at the arc between the electrode and the base metal or work, consequently there are strong radiations of light and heat rays and a considerable throw-off (spatter) of incandescent particles of slag and molten metal. Gases and fumes are generated at the arc during welding, the character and quantity of which are related to the metal being welded, the type and diameter of electrode used, and the amount of current.



PORTABLE UNIT *for outdoor work include two 500-ampere welders. Safety features are steel mounting platform fitted with lifting eyes, platform space for coiling cables, open circuit voltage control, breaker connections for primary service, and grounding cable combined in 3-conductor primary cable.*

Education of Operators

These conditions call for education and protection of operators from injury due to shock, burns and light radiation, provision for a suitable work area with ventilation as required by the character of work, and protection of property from fire.

Referring first to electric shock, normally the work set-up is such that the work is grounded, and unless care is exercised, the operator can easily become grounded. The voltage existing between the electrode holder and the ground, during the off-arc or no load period, is the open circuit voltage of the welder, and the operator can become exposed to this voltage while changing electrodes, setting up work, or changing working position; unless he is properly instructed and uses the equipment provided for his protection.

The open circuit voltages, either dc or ac, required for satisfactory welding are low by comparison with voltages used on lighting circuits or other portable industrial tools and normally would not cause injury or severe shock. The fact that they are low may and does lead to carlessness, consequently, operators should be carefully instructed on how to avoid shock. The danger is particularly present in hot weather, when the operator is sweaty, or when he is wet. He should develop the habit of always keeping his body insulated from both the work and the metal electrode and the holder. Particularly, he should never permit the bare metal part of an electrode, the electrode insulation, or any metal part of the electrode holder to touch either his bare skin or any wet covering on his body. Consistent use of well-insulated electrode holders, well insulated cables, dry protective coverings on the hands and body, and insulation from ground will be helpful.

Partially used electrodes should be removed from holders when not in use. The operator should have a place to lay down his holder or hang it up when not in use in a manner that will avoid contact with persons or conducting objects.

Operators should further be instructed in checking this equipment to make sure that electrode connections and insulation on holders and cables are in good condition.

In the interests of safety, the NEMA Standards establish the maximum open circuit voltage for industrial ac welders at 80 volts for manual welding and 100 volts for machine welding. The ASA Code names 100 volts for single operator dc welders, 80 volts for ac welders when used on manual welding and 100 volts for ac welders used on machine welding as the maxima for open circuit voltages.

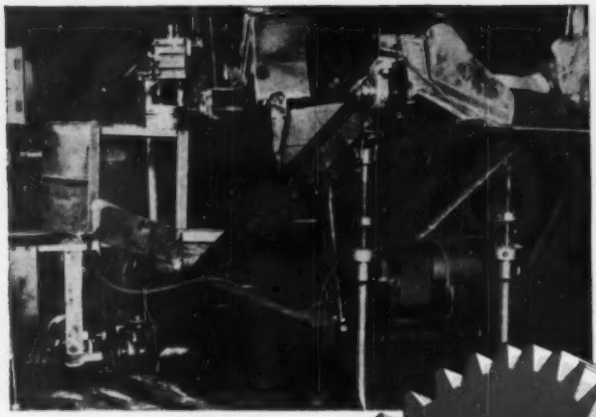
The operating savings possible on most welding applications through the use of ac instead of dc welders has rapidly expanded the use of ac welders, limited until recent years by lack of a complete range of electrode types that would operate satisfactorily on the lower open circuit voltages named above as standards. This progress has brought up the usual questions and discussions as to whether alternating current was more hazardous than direct current in the range of voltages used in welding.

The degree of shock injury depends upon current and not voltage. The current through the body is limited by the contact resistance at the surface of the skin and the body impedance. The contact resistance of dry skin may be as high as 100,000 ohms per square centimeter, but under extreme experimental conditions of wet hands and feet in the water and contact and body resistance may drop as low as 1000 ohms.

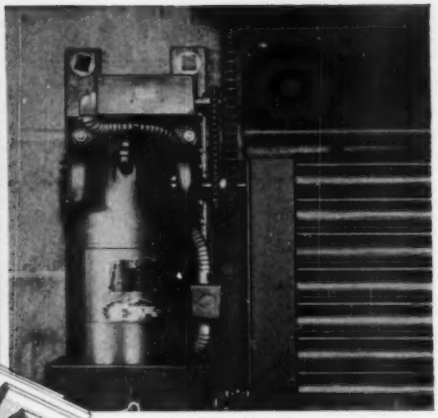
PORTABLE FOLDING SCREEN *between operators is protective measure. Here shown is operator welding large bedplate adjacent to automatic welding operation beyond screen at right.*

Voltages, either ac or dc that are high enough for good arc welding are substantially higher than any voltage that could be considered safe in the sense that it would be considered harmless under the worst conditions represented by the lowest body resistance, yet our ac welding voltages are much lower than the 110 volts used on our lighting and domestic appliance circuits.

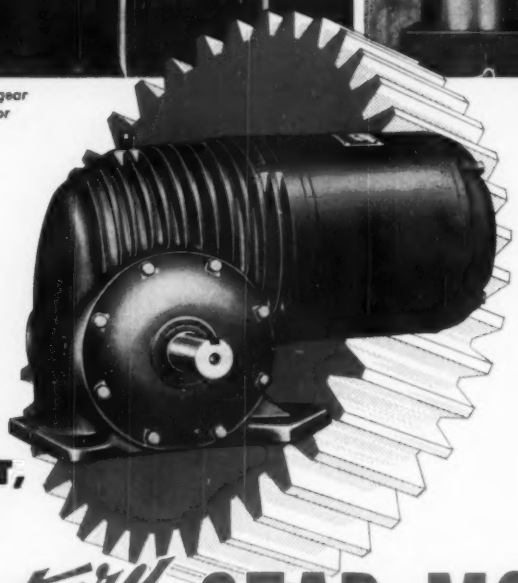
Automatic open circuit voltage controls, which automatically reduce the open circuit voltage to approximately 30 volts may be provided for ac welders used in outdoor work where operators



Century ¼ horsepower gear motor driving a conveyor



Century ½ horsepower gear motor operating a door opener



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Century Gear Motors are engineered to maintain the high torque slow speed shaft in rigid alignment. The gear housing and mounting feet are cast in one piece to provide extra strength and rigidity. In addition, the slow speed shaft is located near the base for greater strength and rigidity.

The motor is equipped with ball bearings and the shaft with tapered roller bearing.

Century Gear Motors are available in sizes from ⅛ to 1½ horsepower — single phase, polyphase and direct current.

Specify Century Gear Motors for all your slow speed power requirements.

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may be working on wet steel where it is harder to keep dry, or for use in confined quarters where there may be greater probability of the operator getting across the open circuit voltage due to restricted space.

The voltages used in ac or dc welding are not hazardous under normal operating conditions, but the data developed by these investigators emphasize the importance of instructing operators on how to keep conditions normal through the use of good cables, well insulated holders and attachments, dry protective gloves and clothing.

The personal protection of the operator from the radiant arc energy and from burns from spatter require suitable helmets with protective filter lenses, protective gloves and other protective clothing such as sleeves, capes, aprons and leggings depending on the size, nature and location of the work. Except for light work, flame proof gauntlet type gloves should be used.

Helmets or face shields should be used on all welding operations and care must be exercized to keep them in good condition. The helmet is primarily for the use of the operator and the use of face shields should be confined to inspectors or others who might have occasion to watch the welding.

Operators working close together or other workmen who might be in the immediate vicinity of an operator's arc should be protected by screens if proximity and conditions require. We have not seen any rules governing this point and shop conditions are so varied that fixed rules would be difficult to set. This is a condition which should be observed and corrective action taken if there are indications of trouble.

Goggles, clear or tinted, should be worn by operators, inspectors or other spectators in the vicinity when welds are being chipped and cleaned.

Protective equipment for the eyes, face and head should conform to the American Standard Safety Code for Protection of Head, Eyes and Respiratory Organs. Protective clothing is covered in the American War Standard Specification for Protective Occupational Clothing.

Under ordinary conditions, when the welding of clean carbon steel is carried on in large or well-ventilated areas with bare or coated carbon steel electrodes, experience has shown that no health hazard exists.

Under certain conditions of welding, health hazards due to gases, fumes or dusts may exist. These possible hazards are not serious except when operating in spaces not properly ventilated and are almost entirely due to the presence of gases, dusts and fumes containing lead, zinc, cadmium, fluorine or compounds thereof. When such hazards are present, sufficient ventilation or in-

SOME SUGGESTED RULES FOR SAFE ARC-WELDING OPERATIONS

Equipment and Welding Circuits

1. Keep welding leads and primary power leads clear of ladders, passageways or doors. Keep leads and cables used for power service to portable welders out of places where there is possibility of machines or trucks running over them.

2. Repair or replace defective cable immediately. Use insulated cable connectors of the locking joint type, having a capacity no less than the capacity of the cable. Disconnect power before splicing any cable.

3. Do not allow power supply cable used for portable welders to become tangled with the welding cables or to be near enough to the welding operation to sustain possible damage to the insulation from sparks or hot metal.

4. Do not weld without all electrical connections, power supply, welding leads, holder and ground clamp being secure and the welding machine frame well grounded. The work clamp must be securely attached to work before any welding is carried on.

5. Disconnect welding machine from power supply when it will be left unattended.

Personal Protection

1. Do not strike an arc without first having face shield or helmet protecting the face and eyes. Anyone in the vicinity of the welding arc should be protected also.

2. A skull cap should be worn under the helmet.

3. Make sure the face shield or helmet is light-tight and adequately protects the eyes, head, face and neck.

4. When chipping slag, use chipping hammer or pneumatic chisel and have goggles on. Hold one hand over head of hammer or chisel as a shield to block particles of slag from flying promiscuously.

5. Wear good leather gloves of the gauntlet type. Wet or worn gloves have lost all protective qualities and should not be worn.

6. Wear high-top shoes to prevent weld spatter burns on the feet and ankles.

7. Weld in a dry place and with dry equipment. If conditions are otherwise, supervising personnel with authority should approve the operations.

8. Keep shirt sleeves buttoned and pockets closed to avoid catching weld spatter which would cause burns.

9. Inspect personal protective equipment before beginning to weld.

10. Treat all electrical circuits with the utmost respect. This includes not only the welding machine, but portable electric tools, lights, blowers, etc. Do not remove light bulbs without turning off current. Exposing yourself to electric voltage does not develop immunity. Keep dry and use special precautions to insulate the body when clothing is wet from perspiration or other moisture.

11. Weld with a fully insulated electrode holder.

12. Remove electrode stubs from the holder only when the body is not in contact with the work.

13. Do not weld in any confined quarters without installing positive ventilation to assure a good current of fresh air being supplied.

14. When welding or cutting brass, bronze, galvanized steel, cadmium-coated steel, or metals, coated with lead or zinc-bearing paint either indoors or in open air, make sure that appreciable quantities of the fumes are not breathed. An individual suction air line or a good respirator will provide protection.

15. In laying down holders or hanging them up, when not in use, put them in places where they will not come in contact with other workers or other holders.

Fire Prevention

1. Weld only in properly authorized areas.

2. Do not weld without removing combustibles or flammables from the vicinity. If possible to avoid welding in areas where combustible materials are present, as may be the case in maintenance operations, post a watch for at least 30 minutes after cessation of welding to make sure smoldering fires have not started.

3. Place stub ends of electrodes in metal containers to prevent accidental body burns or fires.

4. Have a fire extinguisher readily available.

5. Any container that has held flammable material should be thoroughly washed out or steamed thoroughly. Then fill the container with water and drain down to a point just below where the welding is to be done. An opening should be provided to allow steam or air to escape. Welding should not be started on jobs of this type without permission from the proper Supervisor.

6. It is advisable to remove the fuel tank from any motor-driven vehicle before any welding is performed. If this cannot be done, protect the tank and fuel lines adequately from spatter by asbestos board, asbestos paper or asbestos blankets.

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TAPES

assure BETTER INSTALLATIONS
BETTER WIRING JOBS

ACCURATE FRICTION TAPE — Saves time on toughest jobs! It never ravels, tears off clean always, has extra strength for tight, fast wrapping. Clean to work with, Accurate Tape sticks permanently to the work—never to your fingers. For safe, sure protection from abrasion, scuffing and pinching, there's no substitute for Accurate Friction Tape.

ACCURATE RUBBER TAPE — Made from an unvulcanized rubber compound with plenty of extra stretch for tight, neat wraps over the most irregular surfaces. Soft and pliable, too, for quick and safe coverage of pigtail connections. Fuses thoroughly without heat to form a solid dielectric covering — affords lasting protection against electrical leakage due to moisture and humidity.

SEND FOR THIS TAPE CATALOG!

The new Accurate Catalog includes complete information on friction, rubber and Accurate specification tapes with roll length and packaging data on each. Keep a copy handy. Just call or write for yours, now, to ACCURATE MANUFACTURING COMPANY, GARFIELD, NEW JERSEY.

IF IT'S TAPE... IT WILL PAY YOU TO MAKE SURE IT'S ACCURATE TAPE

amc

dividual respiratory protection must be provided.

The harmful fumes or gases, containing lead referred to above, would be present when an operator is welding or cutting lead, lead-bearing steel or steel coated with lead-bearing paint. Zinc fumes would be present when working on galvanized steel, brasses or bronzes, or steel coated with zinc-bearing paint. Steel parts are frequently coated with cadmium to prevent corrosion when used in industrial work, and welding on such steel gives rise to cadmium-bearing fumes.

The coatings on stainless steel electrodes contain compounds bearing fluorine which has doubtless given rise to erroneous thinking on stainless steel welding. These compounds are extremely stable and experimental work indicates that, under ordinary conditions of use, harmful amounts of fumes are not produced from stainless steel welding, yet it is important that good ventilation always be provided when this class of welding is being done.

Some nitrous oxide is present in all welding, yet experience shows that harmful effects from this gas are found, with the possible exception of welding done in extremely confined spaces, without ventilation.

Under the subject of ventilation, let us consider (1) Welding in the open air—outside; (2) Welding indoors; and (3) Welding in confined spaces.

Positive ventilating devices for fume removal or respiratory protective equipment are not required in welding operations conducted in the open air, except when an operator is engaged in welding or cutting lead or cadmium-coated metals or metals covered with lead, mercury or cadmium-bearing paint. The operator must not breathe appreciable quantities of such fumes. Local exhaust ventilation can be used to draw the fumes away from the operator or respirators can be worn. Respirators are relatively inexpensive and provide good protection.

For continuous welding operations, in industrial practice, it is generally considered that if an operator has less than 10,000 c.f. space allowance, ventilating fans which will assure 3 to 4 changes of air per hour should be installed.

For less extensive, intermittent or even occasional welding in small shops, care should be taken to see that open windows, doors or roof vents provide air changes. If this cannot be arranged, an exhaust fan should be installed.

Positive ventilation, such as an air suction line, should be provided to exhaust the fumes arising from welding or cutting metals containing, or coated with, lead, zinc, cadmium or mercury.

All welding or cutting operations

NEW BENJAMIN "Series 40"

Meet Your Lighting Plan's Most Exacting Specifications!

Yes, you'll find that your most exacting specifications for the newest developments in fluorescent lighting are fully met in the new Benjamin "Series 40"! In this new Benjamin Fluorescent Lighting Line are advancements which insure better shielding of the lamps from the eye, improved operation and easier installation and maintenance. In addition, there is advanced styling . . . the eye-pleasing beauty of streamlined design.

However, as is usual with all Benjamin Units, you get more than new features in the new "Series 40". You get famous Benjamin built-like-a-battleship construction and all the many other factors which go to insure efficient and easily maintained illumination of work places.

Recommend and specify Benjamin Fluorescent Lighting Units. Get the complete story—learn why you light right when you light with Benjamin. **BENJAMIN ELECTRIC MFG. CO., DEPT H, DES PLAINES 20, ILL.**

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1. One-Piece Drawn Metal Housing
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Wagner Bearings Are *BEST!*

Genuine Wagner 87% tin babbit-lined bearings are best because they have:

1. Extreme load-carrying capacity.

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3. High resistance to corrosion by acids present in oils.

...and Easiest to Install
with the new Wagner bearing tool

Worn sleeve bearings can be removed and new Wagner precision-bored bearings can be inserted in a single easy operation with this new time-saving tool. No hammering on bearing . . . *no reaming* . . . no spoilage. You get perfect alignment every time! Four sizes take care of most jobs, including all thin wall, split, or roll bearings. They're priced right, too! Only $11.80 per set. Order yours today. Use the coupon below.

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Please ship the following bearing tools:

Quantity	Tool No.	Fin. Brg. Size	List Ea.
	SA-846	.655"	$2.50
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	SA-847	.812"	3.00
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COMMUTATORS • STANDARD ROTORS
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450 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

M780-B

PNEUMATIC DE-SCALING CHISEL ***is used to remove welding slag. Both operator and inspector wear goggles, the operator wearing his under his helmet while welding.***

carried on inside relatively small enclosed or restricted spaces such as tanks, boilers or pressure vessels must be ventilated by forced ventilation.

The numerous investigations and studies made over a period of years, supplemented by experience shows that permanent harmful effects on the operators health are not experienced in the course of welding operations, and that ventilation can readily be provided to take care of conditions outlined above which require it.

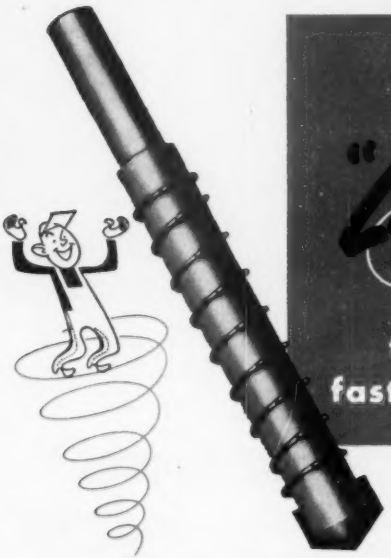
Production welding operations are normally carried on in regularly authorized shop areas, which are and should be kept free from combustible materials, oil, grease, waste, etc.

Welding construction or maintenance operations, usually carried on in a variety of locations outside authorized areas, should not be started until authorized by a person or persons to whom such authority has been delegated by the management.

If, during the course of any welding operation, combustible material has been exposed to sparks or heat, a watcher should remain on the job for at least 30 minutes after completion of the work to make sure that no smoldering fires have started.

Many users of welding equipment have found it helpful and worthwhile to issue rules and recommendations to operators as well as supervisors covering safe operating practices applying to the overall operations, as well as personal protective equipment for the operator. These range from plain printed cards to illustrated pamphlets published in attractive, easily read and understandable style. Publications of this type surely do their part in accident prevention.

Now—the most revolutionary masonry drill ever designed!



CARBOLOY "LIVE-SPIRAL" Masonry Drill

for continuous drilling—
faster, easier, cleaner, deeper

● Here is the most sensational development in masonry drill history—Carboloy Company's new "Live-Spiral" Masonry Drill!

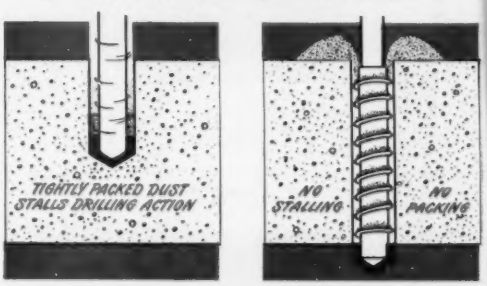
With it you can now drill any type of masonry *without stalling drilling action*—faster, easier, cleaner, deeper and with less pressure. And here's why: A unique, spiral wire—permanently attached at both ends of the drill—cleans the hole as it is drilled, at any depth.

The low-angle "Live-Spiral" lifts out the dust; there's no packing of dust, no need to remove the drill for a fresh start. The cutting tip of Carboloy Cemented Carbide—*the hardest metal made by man*—bites into the toughest masonry.

And here's a surprise: You get this sensational, new "Live-Spiral" Drill at *no price increase*. For example, the ¼" drill lists at $1.40.

Get the facts about this "Live-Spiral" Drill now. Call your nearest industrial distributor or equipment jobber for a demonstration, or mail the coupon for information.

Cleans dust from hole as it drills! No packing or jamming at any depth along entire length of drill!



Ordinary carbide masonry drills will drill to depth about 3 diameters of tip before loading up with tightly packed dust that stalls drilling action.

New Carboloy "Live-Spiral" Drill with Carboloy tip goes all the way without packing, cleans dust from hole, drills continuously... faster, easier, cleaner, deeper.

CARBOLOY®
"Live-Spiral" Masonry Drills

MAIL THIS COUPON TODAY!

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Please rush me complete information and prices on your revolutionary, new Carboloy "Live-Spiral" Masonry Drill.

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WITH FEEDRAIL *in* ELECTRICAL TROUBLES *are out!*

Shut-downs due to faulty wiring and connectors disappear when the totally enclosed Electric Feedrail Distribution System is installed. You don't have to wait even for rewiring when you relocate electrical equipment in your plant.

Hand tools on the production line are connected to the Feedrail trolley in a jiffy and the problem of moving test lines, bench-work, and moveable lights, is solved for all time.

Feedrail is approved by the Underwriters' Laboratories Inc., and endorsed by leading mechanical, electrical and industrial engineers. Can be installed by your electrician or contractor in a few days.

Ask for technical data and bulletins applying to your specific applications.

24-A

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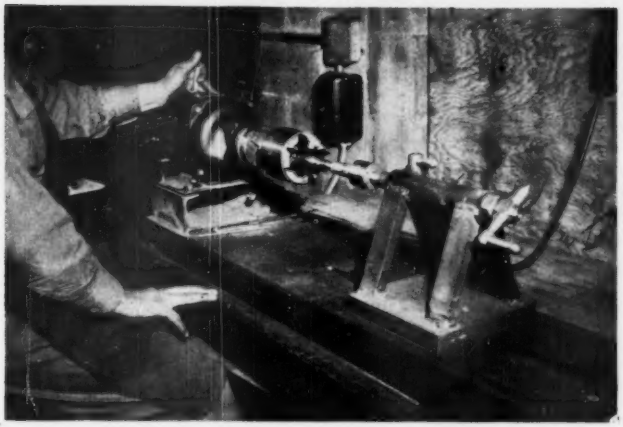
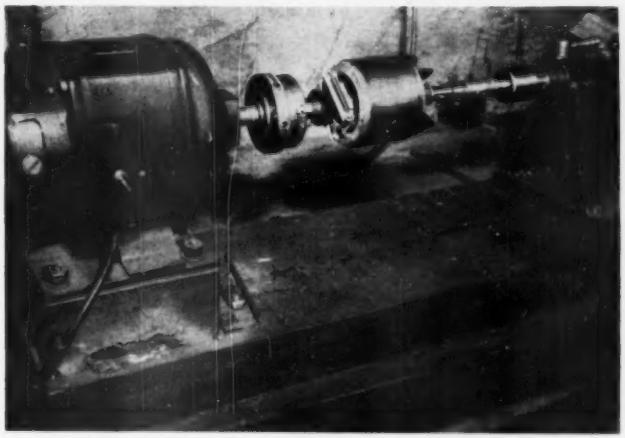
Motor Shops



TESTING GOVERNOR ***on fractional horsepower motor armature. Driving motor speed is varied by operating lever at left; governor "kick-out" speed is noted on tachometer dial.***



ROTOR SHAFT ***is held by universal chuck on motor shaft (left) and live center at right. Support for live center is adjustable for various rotor shaft lengths.***

Unit For Testing Small Motor Governors

All centrifugally operated devices for small motors, such as governors, short circuiting units, etc., are carefully checked and tested before a motor leaves the repair shop of Lansing Electric Motors in Lansing, Michigan. To reduce testing time and increase the accuracy of their findings, the shop mechanics designed and built a compact, simple, testing machine.

Heart of the unit is a ½-hp, single-phase, 110-volt, variable speed motor (300 to 4,000 rpm range) driving a universal chuck that holds the armature under test. The other end or the armature shaft is held in a live center that is adjustable for shaft lengths ranging from 8 to 30 inches. Motor speed is varied by moving a lever on the motor frame; test speed is indicated on a dial-type tachometer. Rotors with shaft diameters up to 1¼ inches can be tested on the unit.

Base of the unit is a 4-foot length of 10-inch steel channel with a 25-inch long slot in the center to permit horizontal adjustment of the A-post support for the live center. The motor base rests on a platform made from two 6½-inch lengths of 3-inch channel welded to the 10-inch channel base.

To test a governor or short circuiting device, the mechanic places the armature shaft in the chuck and live center; varies the motor speed while watching the tachometer dial. When he hears the governor or short-circuiting device "kick out", he records the speed at that moment. Should the unit operate at incorrect speed, necessary adjustment is made and the unit rechecked.

Shop superintendent Fred N. Selby reports that customer complaints traceable to defective governor operation have been reduced some 50 percent since the test unit was built. New governors under test were frequently found to be out of adjustment.

A-Frame Rack For Magnet Wire Storage

Small spools of magnet wire are kept within easy reach, yet out of the way, in the coil department of the motor repair division of the Electric Construction & Machinery Co., Kalamazoo, Michigan. They rest in an A-frame rack mounted on top of the de-reeling frame in front of the coil winding machine, occupying space that normally might be wasted.

The A-frame uprights are made of lengths of 1½-in. by 5½-in. wood, 36-inches high on the vertical, and rigidly braced by wood cross members. Between the two uprights are four tiers of conduit racks per side (two ½-in. conduits per tier on 3½-in. centers) to hold the wire spools. Conduits are supported by holes drilled in the A-frame; except those at the apex of the frame which are mounted by two-hole pipe straps. The vertical distance between each conduit tier is approximately 8½ inches. The complete rack is rigidly mounted to the 42-in. by 28-in. top of the de-reeling frame.

Each tier holds up to ten 4½-in. diameter wire spools, or nine 6-in. spools. Total capacity for the eight tiers is 70 to 90 spools, depending upon size. In addition, spools can be stacked inside the A-frame itself.

The de-reeling table is made of

77% SAVED WITH Ramset

FASTENING SYSTEM

SEVEN TIMES FASTER than with his old method, this contractor set 240 RAMSET FASTENERS through 2″ x 2″ x ¼″ steel angles into concrete with RAMSET—at a saving of $463.00! You can save comparable sums with RAMSET when fastening into steel, concrete, masonry or other hard materials. For proof, ask us for a free Cost Comparison Sheet and put down your actual cost figures. You will see quickly the substantial savings you can make with the light, portable, proven RAMSET TOOL.

RAMSET eliminates slow, costly, tedious drilling, chipping, tapping and plugging. Actual fastening time with RAMSET—less than one minute per fastener with any of the 65 types and sizes of plated RAMSET FASTENERS.

In 20 seconds, RAMSET can be loaded, ready for use. Place the Tool against the work—and RAM! The fastener is SET!—tight and right. RAMSET requires no complicated methods or separate small parts that can be lost or forgotten. RAMSET TOOLS may be cleaned and reassembled in less than five minutes, to keep them at top operating performance.

A 15-minute demonstration will show you how much time, money and trouble RAMSET can save. Call your local RAMSET representative today or ask us for details and free Cost Comparison Sheet.

Ramset System

SAVES TIME . . . CUTS COST ON JOBS LIKE THESE:

Fastening—

- Electrical equipment.
- Wiring and conduit.
- Panelboards and controls.
- Lighting fixtures.
- Bus duct and outlets.
- Supports to concrete, brick and steel.
- Television antennae.

STEMCO CORPORATION

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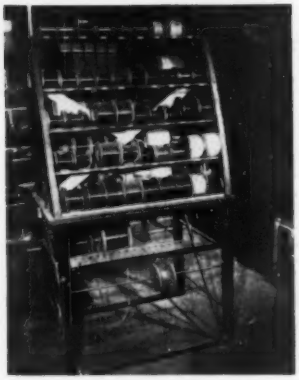
A-FRAME RACK *on top of de-reeling table is used for storage of small spools of magnet wire. Note removable shafts on supporting frame to hold reels in use.*



FRONT VIEW *of storage rack showing conduit "shelves". Rack holds up to 80 small spools. Note fibre board at base through which wire passes on way to winding head.*

angle-iron frame with wood top (36 inches from floor); has removable shafts for mounting reels and spools to feed winding head. Large reels are mounted to back of frame; small spools at front. All magnet wire passes through a fibre guide board at front of frame before it reaches the winding head. Weights on the end of a rope passed over the reels provide the tension during de-reeling.

Bench Turntable For Stator Winding

What was once the side of a 24-inch magnet wire reel is now a turntable on the winding bench in the small motor department of the motor repair division at Barker-Fowler Electric

"Certified" ON A BALLAST...

IS MORE THAN A WORD!

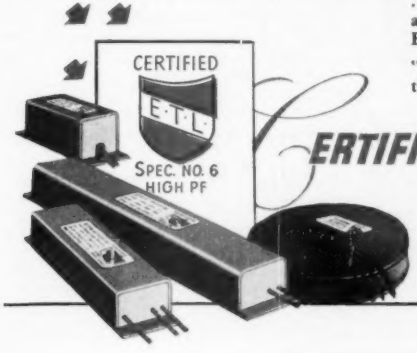
. . . Measuring Certified Ballast temperatures while ballast is operating in an actual fluorescent fixture.

Hot Box! Certified Ballasts are tested and checked against *overheating*. Test oven determines temperature rise.

Certified Ballasts are checked and rechecked in actual service—an additional safeguard for high quality.

When fluorescent lighting fixtures are equipped with Certified Ballasts, you and your customers are protected

CERTIFIED FLEUR-O-LIER MANUFACTURERS, RLM STANDARDS INSTITUTE and CERTIFIED LAMP MAKERS have solved their ballast problems by writing CERTIFIED BALLASTS into their specifications.



YES, "CERTIFIED" on a ballast means that this ballast has been built to exacting specifications set up by lighting experts . . . that it has been *tested, checked* and *CERTIFIED* by impartial Electrical Testing Laboratories, Inc.

"Certified" further means ballasts that are *quiet* in operation . . . protected against overheating . . . and long lived.

Always specify CERTIFIED BALLASTS . . . and be sure!

CERTIFIED BALLASTS are being made by ten leading ballast manufacturers. Participation in the certification program is open to any manufacturer wishing to qualify.

CERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

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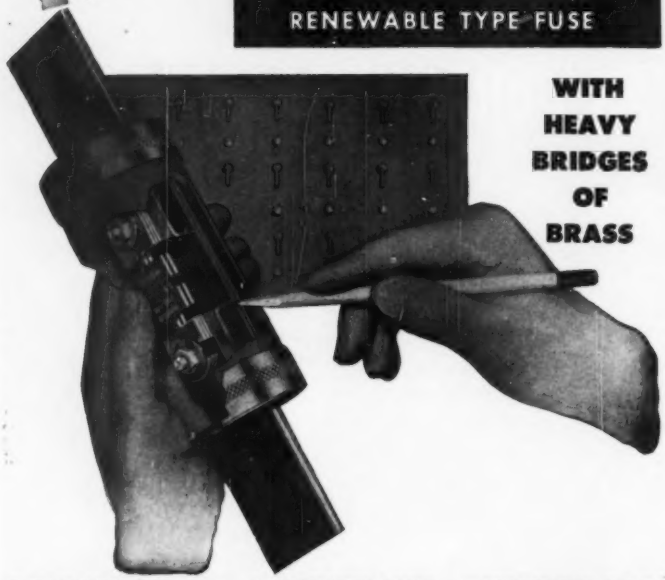
NEW

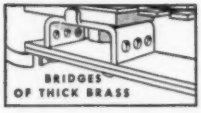
Monarch
HEAVY DUTY
RENEWABLE TYPE FUSE

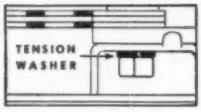


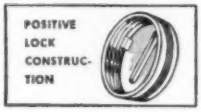
WITH HEAVY BRIDGES OF BRASS

DESIGNED TO WITHSTAND TEMPORARY EXTRA HEAVY OVERLOADS

Approved by Underwriters Laboratory







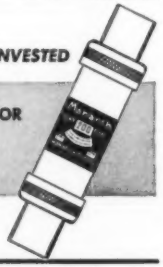
Cool . . Truly Aligned . . Maximum Use of Brass . . . Adding up to Lower Power Waste Than Ever Before! And Here's How!

This new heavy duty fuse incorporates many time-tested Monarch features. The newest, — thick brass bridges widely separating the terminals from the fiber bar and made with ventilating holes—allow ***maximum dissipation of any internal heat.***

The Monarch method of locking these bridges securely to the terminals and fiber bar, together with Monarch's positive lock construction and compressed tension washers, insures ***permanent true alignment.***

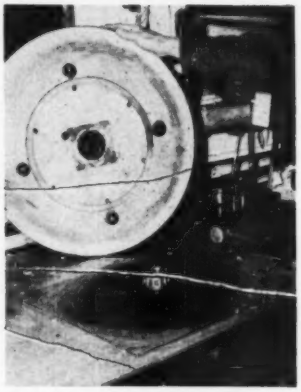
. . . IMPROVED SERVICE PER DOLLAR INVESTED

SPECIFY **Monarch** FOR SUPERIOR **FUSErvice**



MONARCH FUSE CO., LTD.
118 E. First Street Jamestown, N. Y.

BENCH TURNTABLE ***was once side of a 24-inch magnet wire reel.***



UNDERSIDE OF DISK ***showing the four ball casters; also the tapered center bearing on steel plate on bench top.***

Company in Lansing, Michigan. The 1¼-inch thick wood disk (with a steel rim) is centered on a Timken tapered roller bearing and has four ball casters to reduce rotational resistance.

The center bearing is mounted to a 20½-inch by 18½-inch piece of sheet steel fastened to the bench top. In addition to acting as a race for the ball casters on the turntable, this steel plate prevents wear and damage to the bench. The disk can be easily lifted off its center bearing.

Lathe Speeds Coil Winding

The average electric motor service shop often encounters the problem of rewinding coils containing several thousand turns of wire. James Adams, instructor of industrial electricity in the Madisonville area trade school in Kentucky mentions that a handy trick

NASHVILLE SCHOOLS Choose GIBSON

THE HIGHLANDER 5200

Beauty at low unit cost; streamlined louvers. Stamped from 20 gauge cold rolled steel or heavier. Efficiency nearly 82% by E. T. L. analysis. Available in 430 MA 48" and 96" lengths.

THE BILTMORE 5500

85.5% efficient. Stamped from 20 gauge cold rolled steel or heavier. Hot-bonded synthetic enamel finish and only finest E.T.L. approved components used. Available in 438 MA 48" and 96" lengths.

An installation of the Gibson 5500 Biltmore in the library of West End High School, one of Nashville schools using nearly 7,000 Gibson fluorescent fixtures.

Progressive planning and investment in the health and education of our youth demands the best. Gibson features two excellent fixtures for schools. The Biltmore 5500 is the most efficient louvered fixture on the market today—85.5% by Electrical Testing Laboratory analysis.

This attractive fixture was especially designed for installation in schools and public buildings where high intensity lighting at low cost is essential. Where additional beauty is desired at low unit cost, the Highlander 5200 fills all requirements. It is finished in natural satin aluminum with white enamel louvers having translucent Polystyrene side panels.

Planned lighting with quality fixtures is the key to visual health. As a free service, lighting engineers of Gibson Manufacturing Co. will lay out lighting plans to fill the specific needs of school buildings, without cost or obligation to you. Write us today about Gibson Planned Lighting.

Newsweek

TIME
THE WEEKLY NEWSMAGAZINE

GIBSON Manufacturing Co.

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You can do a lot

with a little GOLD SEAL TAPE

There's more tape value in every roll because there's no waste. Gold Seal Tape *goes further.* And, rain or shine, you can depend on it to stick to the job . . . speed the work. Try Gold Seal Tape next time. In single rolls and handy 10-roll containers. Jenkins Bros. (Rubber Division), 80 White St., New York 13.

JENKINS Gold Seal Tape
FRICTION...RUBBER

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

in such cases is to unwind and rewind the coil in a lathe and let the lathe carriage do the counting. This is accomplished by making a wooden form the size desired for the new coil, fastening a block on the side of the form to be chucked in the lathe. The form is then chucked and the old coil mounted.

The lathe carriage is brought as near to the headstock as possible and adjusted to feed towards the tailstock. All backlash in the direction of the headstock is taken up and the lathe bed plate is marked to indicate the starting point. When the lathe is started the coil is unwound. After the form is insulated the lathe is reversed and the new coil is wound. As the winding proceeds, the carriage returns to its original starting point marked on the lathe bed and, when it reaches this point, the same number of turns will have been wound on the new form as were removed from the old coil. If it is desired to know the number of turns in the coil, the number of inches traveled by the carriage can be divided by the carriage travel per spindle revolution. For example; if the carriage traveled 20 inches and carriage feed is 0.002 inches per spindle revolution, the number of turns would be 10,000.

This simple method of counting revolutions makes double use of the shop lathe, it is rapid in operation, positive in its accuracy and is a time- and labor-saving method.

For unexcelled dependability and permanence
Specify and Install
AEMCO TIME SWITCHES

EQUIPPED WITH SYNCHRONOUS, SELF-STARTING MOTORS

Highest quality material and unexcelled craftsmanship combine to make Automatic Time Switches the preference of those who demand *long life dependability backed by an unconditional guarantee.*

Compact, *carefully engineered* Automatic Time Switches have new type, easily set trip levers. Trip levers and dial are visible thru window in attractively finished, tamper-proof case.

Stock Models: Single Circuit, Single Pole, 10 Amperes Capacity to Two Circuit, Four Pole, 45 Amperes Per Pole Capacity. Special models engineered to your requirements.

A. C. OR D. C. OPEN OR CAN TYPE WITH TUBE-BASE PLUG-IN FEATURES

AEMCO RELAYS

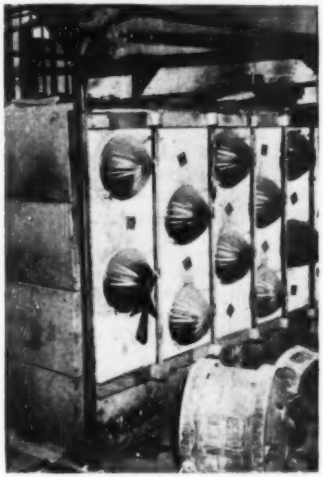
Automatic Electric Relays . . . Midget, Interlocking, Circuit Control, Latching, Adjustable . . . are built to exacting high standards to assure unexcelled dependability. Custom built relays designed to your specifications.

Accurately rated Automatic Electric Relays deliver "Diamond Quality" performance.

Write for complete specifications.

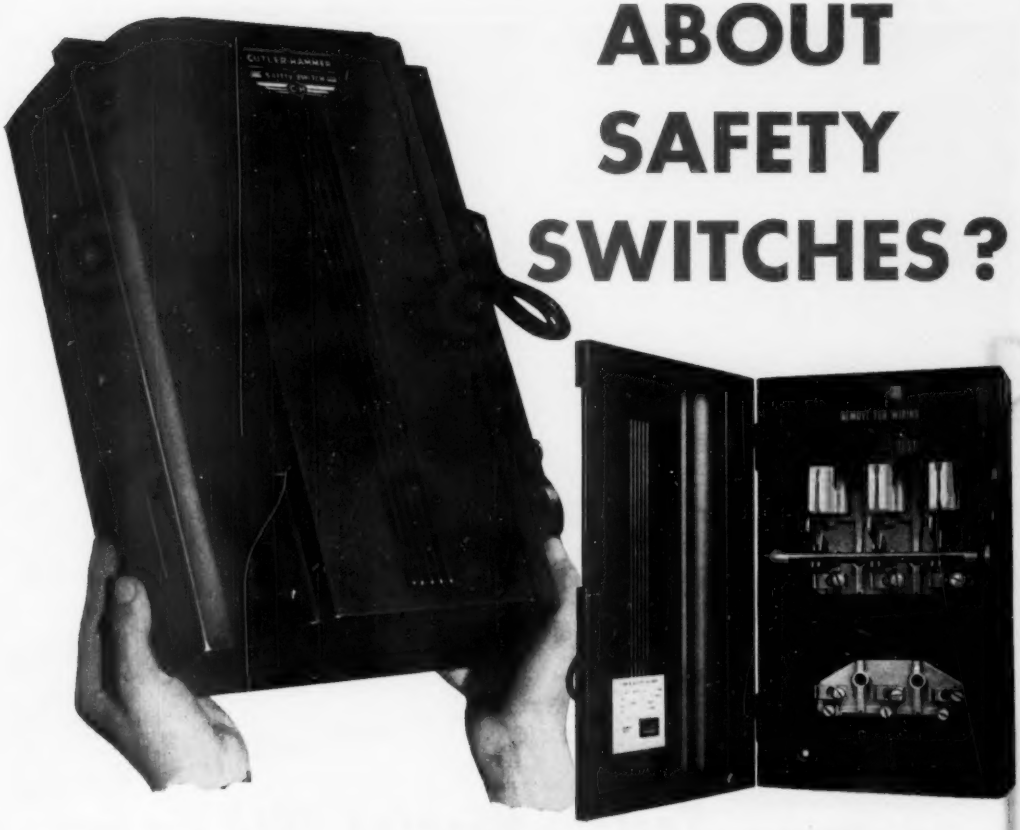
LOOK FOR THE DIAMOND SEAL FOR DIAMOND QUALITY

AEMCO Automatic Electric MFG. CO.
50 STATE STREET
MANKATO, MINNESOTA



Green jewel in base of reflector for each of these 1000-watt clear infra-red lamps (arrow) indicates if individual units are operating in this 16-kw. bake oven at Lansing Electric Motors, Lansing, Michigan, motor repair shop. The 10-ft., by 6-ft. by 5 ft., 3-in. oven is dual-heat and automatically controlled by thermostat and time clock.

what are the FACTS ABOUT SAFETY SWITCHES?



1 IS "INTERNAL HEATING" IN SAFETY SWITCHES IMPORTANT?

Engineering research fully authenticated by outstanding authorities shows "internal heating" in Safety Switches to be the principal cause of Safety Switch failures.

2 HOW DOES "INTERNAL HEATING" CAUSE SAFETY SWITCH FAILURES?

By literally baking the life out of Safety Switch parts. It causes insulating materials to disintegrate, metal parts to warp and corrode, so switches either become inoperative or "burn up" through inability to carry the load.

3 WHAT CAUSES "INTERNAL HEATING" IN SAFETY SWITCHES?

In properly constructed Safety Switches, fuses are responsible almost exclusively for "internal heating." This is no criticism of fuses; it is unavoidable. Any fuse carrying its rated load *must* be near its melting point if it is to perform properly when an overload occurs. Any metal operating *near* its melting point must be *hot* and fuse links *are* hot, with temperatures running as high as 780 degrees Fahrenheit.

4 HOW CAN THE TROUBLE FROM "INTERNAL HEATING" BE OVERCOME?

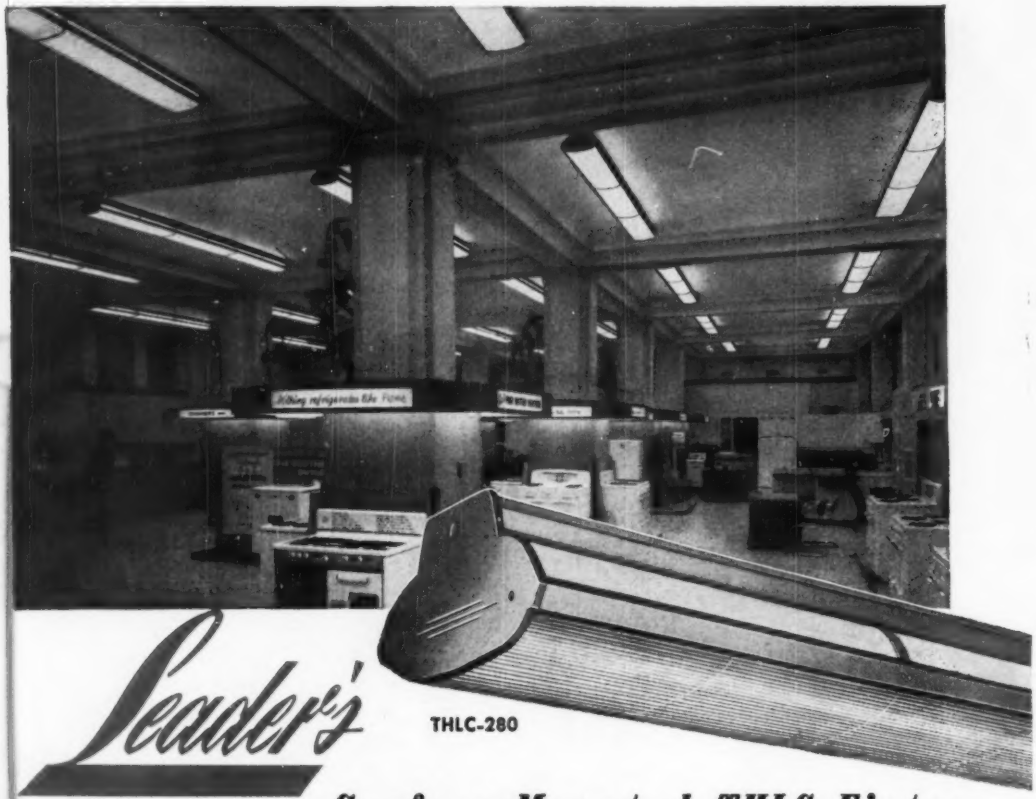
As the adequate enclosure so fundamental to *safety* in Safety Switches makes thorough venting of the trapped heated air impossible, the only escape from the ravages of "internal heating" can come through selecting materials for the internal structure and designing this structure to successfully withstand the unavoidable heat conditions to be met in service.

5 WHAT SAFETY SWITCHES AVOID "INTERNAL HEATING" TROUBLES?

Cutler-Hammer Safety Switches. Cutler-Hammer Safety Switches were completely redesigned *ten years* ago to beat "internal heating" when engineering research clearly indicated the need for *such* Safety Switches. Nine years of experience shows the Cutler-Hammer claim of better Safety Switch performance far more than a mere promise; it is a proven *fact*. Ask the men who use them. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wis.

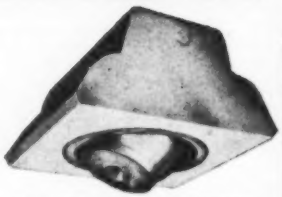
CUTLER-HAMMER
SAFETY SWITCHES
C-H

Achievement in LUXURY *lighting*



THLC-280

Leader's Surface-Mounted THLC Fixture



COMPANION SPOTLIGHT OPTIONALLY AVAILABLE

For use between THLC units in continuous runs, or at ends of run. Furnished with chrome-plated ball and ring assembly affording adjustment of 360° horizontal and 25° from vertical in any direction . . . or with flat Holophane* glass lens.

Here's a lighting fixture that emphatically proves: the secret of attaining the grand manner begins at the ceiling. A ceiling studded with Leader's luxury lighting fixture—the THLC—produces an atmospheric charm that apparently comes out of nowhere. Here is extreme beauty and quality illumination. In generous 14 7/16" width, with a smart, curved, light-diffusing Holophane* Controlens to handsomely shield two, three or four standard 48" 40-watt lamps, or Slimline lamps in various lengths up to 8 ft.

THLC SPECIFICATIONS

Housing and channel of heavy-gauge steel. Exterior finished in aluminum gray baked synthetic enamel, interior in white, high-gloss baked enamel. Furnished with curved type Holophane* Controlens (hinged for easy servicing) and curved type glass Controlens at top of exterior. Wired units include UL and ETL approved sockets and high p.f. 2-lamp ballasts, type FS easily replaceable starters. 110-125 volts, 60 cycle A.C. Other voltages and instant-start operation available on request.

Sold and installed only by the better electrical wholesalers and contractors

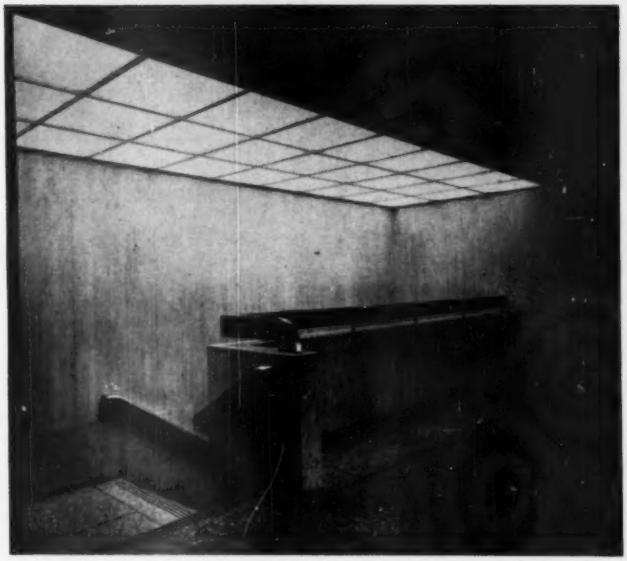
*Copyright Holophane Co.

LEADER ELECTRIC COMPANY

3500 North Kedzie Avenue • Chicago 18, Illinois

Leader Electric Western—800 One Hundredth Ave., Oakland 3, Cal.

Modern Lighting



LUMINOUS CEILING ***above stairwell consists of square opal-glass panels lighted by parallel rows of 25-mm. cold cathode tubing, 15 inches on centers and 15 inches above the glass level. Intensity on upper steps is 30 fc.***

Ceiling Treatment Uses Parallel Coves

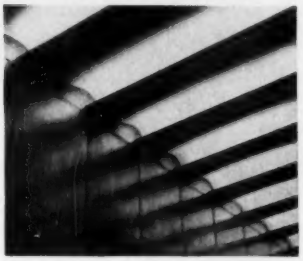
Two dramatic illumination techniques are combined to achieve distinction in the main lobby of the recently-completed Esso Building, the 15th structure to be erected in Rockefeller Center, New York City.

The first treatment lights the entire lobby, which extends 169 feet from entrance to entrance, measures 59 feet in width, and rises to a ceiling height of 17½ feet. This area, with the exception of central islands of high-speed high-rise elevators, and two sections where the flanking construction of an information lounge and restaurant border the lobby, is canopied by 47 parallel ceiling coves of special design resembling the formation of successive waves. Of these coves, 21 extend the entire width of the lobby, 15 are interrupted by the elevator banks, and the remaining 11 are shortened due to the flanking construction just mentioned. Eight circuits are allocated for the night lobby lighting, although all circuits are in operation during normal working hours. In all, there are 39 transformers of 600-450-watt capacities, contained in recessed cabinets in the upper side walls and covered by flush wall-matching panels. Each ceiling cove contains two rows of cold cathode tubing operating at 120 milliamps. Lamps are warm white and 3000 degrees Kelvin, with ends staggered to minimize dark spots on the ceiling. At eye level, intensities throughout the lobby average 20-fc.

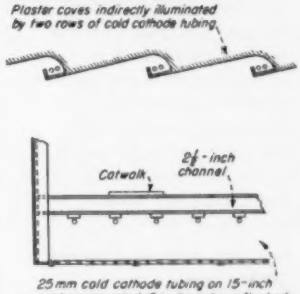
The second treatment illuminates a wide stairway descending from the main lobby to a block-square concourse beneath Rockefeller Center. This treatment consists of a completely luminous ceiling, with 25 millimeter cold-cathode tubes mounted in parallel rows, 15 inches on centers and positioned 15 inches above a flashed opal glass ceiling above the stairwell. Transformers for lamps, and catwalks for servicing the installation, are located above.

Pollak and Grieve were the consulting engineers, working with architects Carson and Lundin in designing the lighting installation. Cove lighting equipment was manufactured by the Cold Cathode Lighting Company and transformers were products of the Lexington Electric Power Company. Eastern States Electrical Contractors, Inc., installed the electrical work.

MAIN LOBBY ***in new Esso Building, Rockefeller Center, is illuminated by 47 parallel ceiling coves of special design resembling the formation of successive waves of light. Average illumination throughout lobby is 20 footcandles.***



COVES ***have two rows of cold cathode tubing with ends staggered to eliminate dark spots on the ceiling. Transformers are contained in recessed panels set flush with the bronze walls and covered by wall-matching bronze plates.***


Plaster coves indirectly illuminated by two rows of cold cathode tubing
Catwalk
2½-inch channel
25 mm cold cathode tubing on 15-inch centers, mounted 15 inches above flashed opal panels

CROSS SECTIONS ***through lobby ceiling and luminous panels above stairway indicate methods used to guarantee adequate cut-off angles and even diffusion and distribution.***

over the counter

slater sells

on the job

slater serves

*New one piece combination, specification grade, using now-famous removable Slater No. 215 interior.

Whether you are a consulting engineer specifying Slater, or a jobber selling Slater devices, you always have a feeling of confidence that you are backed by twenty years of sound engineering experience, the smoothest production methods, and a certain built-in longevity that has brought meaning to our claim of "Lifetime".

New 1950 catalogue on request.

Slater ELECTRIC & MFG. CO.

Dept. 4, Woodside, N.Y.

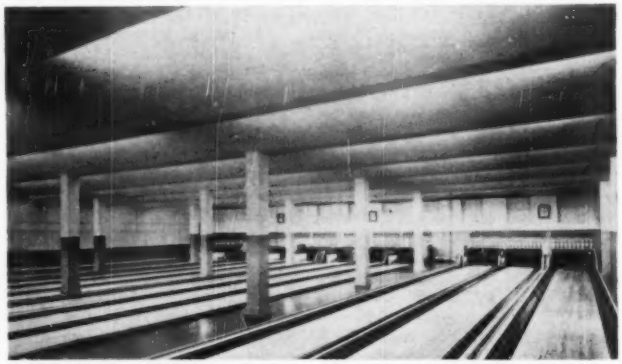
CEILING-MOUNTED UNITS *of louvered and glass-paneled fluorescent fixtures and adjustable incandescent spots maintain general illumination levels of 45 footcandles. Recessed R-40's over display counters raise intensities in these areas to 120 footcandles.*

Lighting Plan Promotes Sales

The new jewelry store of Wiss Sons, Inc., in Montclair, N. J., recognizes the importance of lighting designed to attract shoppers, effectively present the displayed merchandise and assist in the promotion of sales. To achieve these objectives, both incandescent and fluorescent fixtures have been installed; the former planned to accent special areas and the latter for general illumination.

Three surface-mounted series of incandescent-fluorescent units are positioned on the 14-foot ceiling, each series consisting of five fluorescent 4-lamp 40-watt luminaries and six adjustable, ornamental spotlights equipped with 150-watt G.E. side-prong base PAR-38's. Fluorescent units, having louvered bottoms and glass side panels are progressively located between the incandescent spots. Both incandescent and fluorescent components are manufactured by the Newark Electric Fixture Company. Highlighting is accomplished by installing 150-watt R-40 reflector flood lamps in the ceiling areas over display cases and centrally-positioned merchandise. Show cases behind side display cases are top lighted by single fluorescent lamps, a total of 39 lamps being used for this purpose, including lamps of 40, 30 and 20 watts.

Between 80 and 120 footcandles are delivered to counter tops. The silver display desk receives 80, and 45 footcandles are the average in the adjoining areas. Brightness ratios are less than 12 to 1, with 68 foot-lamberts in wall niches, 41 in show cases, 12 on the ceiling and floor, and from 5.8 to 25 on the walls of the store.



CONCEALED LIGHTING *eliminates disturbing direct glare from the players' eyes in the newly lighted Westinghouse employee bowling alleys, East Pittsburgh, Pa. Using 2 140-watt industrial reflectors, R. G. Edsall, Works Engineer, redesigned the flat ceiling into a saw-tooth design and concealed the reflectors in the recesses. The lighting units are completely concealed from the bowling position.*

USERS SAVE 2/3

with

Westinghouse *Fluorescent Lamps*

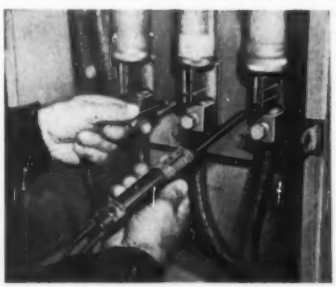
the lamps that last 3 times as long... yet cost no more!

Yes, one Westinghouse fluorescent lamp now lasts as long as 3. In average store installations, for example, it lasts 2½ years; in average one-shift offices or factories, 3 years. You actually buy lamps only ⅓ as often! You also save on the time spent replacing *burned-out lamps*. So, start getting these economies now. Next time specify Westinghouse fluorescent lamps. Lamp Division, Westinghouse Electric Corp., Bloomfield, N. J.

YOU CAN BE SURE... IF IT'S Westinghouse

Now ..
None of This-

The KNOPP
Voltage Tester
with the
PROD-MOUNT
Saves Time,
is Reliable!



Has 5 Safety Features . . . Many Uses

Say "Goodbye to risky, time-wasting fuss in testing" with the 5 main safety features in the Knopp Voltage Tester: (1) exclusive Prod-Mounting Socket in housing making this tester easier, faster, and safer to use and ending time-wasting "three-handed" testing; (2) protection through Dual indication of voltage by solenoid and neon lamp working independently; (3) positive scale readings; (4) signal by hum and vibration; and (5) thorough insulation throughout, even to the sharp point of each prod.

Well built and shock-proof in a LAMINATED bakelite housing, the Knopp Voltage Tester tells immediately and simply if circuit is open or closed; magnitude of voltage between 110 and 600; a-c or d-c, pure or rectified; 25 or 60 cycles—for testing old and new circuits, fuses, locating grounds, etc.

Get the widely-used and reliable Knopp Voltage Tester with the Prod-Mount, and other safety features, from your dealer, or write for illustrated, free information sheets.

ELECTRICAL FACILITIES INC.
4232 Holden St. Oakland 8, Calif.

SHALLOW TROUGHS *are formed between continuous lines of ceiling-mounted fluorescent units, giving impression of added height and solving the problem of uneven beam construction.*

Lighting Plan Solves Structural Problems

The Union Market National Bank in Watertown, Massachusetts, was faced with two structural problems when relighting was considered: an uneven beam construction on the ceiling and a low balcony surrounding the central banking area. Both problems were solved by installing recessed fluorescent units, in parallel end-to-end lines along the ceiling and singly beneath the balcony. Ceiling beams were then hidden by shallow v-shaped troughs, giving both interest and an impression of added height to the ceiling. Although this installation delivered an average of 35 footcandles to desk level, added illumination for teller's convenience was obtained by installing single 40-watt lamps above desks, shielded by waist-high counter tops.

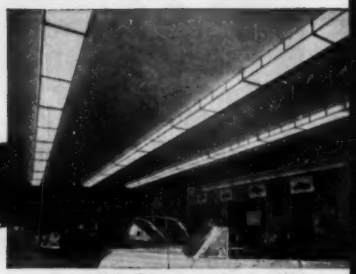
MODERN LIGHTING *is combined with modern building materials to produce a most attractive and colorful waiting room at Lincoln Rochester Trust Company, Rochester, N. Y. The cove contains a single row of 25 mm. cold cathode tubing, and the downlights are 200 watt incandescent louvered distributing type. The combined illumination is 25 footcandles average. Offices beyond partition are lighted to 60 footcandles average by continuous row recessed troffers, glass covered, on 7-foot centers, each containing two rows of 40 watt fluorescent lamps.*

YOU SELL MODULE INSTALLATIONS

General Office. *Chicago, Ill.*

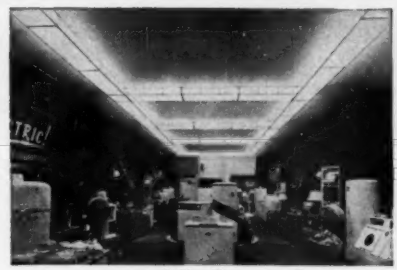
LIKE THESE

Bank. *Wheeling, W. Va.*

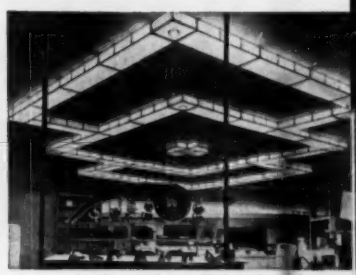


Automobile Showroom. *Ecorse, Mich.*

Display Room. *Dallas, Texas*



Utility Showroom. *Trenton, Mich.*



Appliance Store. *El Dorado, Ark.*

WHEN YOU TELL THIS SELLING STORY

module is custom-fitting

Here's the *new* lighting that *fits* any commercial interior to a "T". Four basic MODULE units are the "building blocks" or "dominoes" of light. They fit together easily, economically, to form over 50,000 different patterns. They custom-fit any room shape or size. They put the light *exactly* where it's needed. MODULE is the *only* lighting that *custom-fits* with standard low-cost units.

module delivers 20% MORE LIGHT

Proved in actual use—MODULE delivers 20% EXTRA light per unit! Yes—the MODULE translucent plastic molded louver passes 20% MORE LIGHT. This means more light per dollar—fewer fixtures required to meet footcandle specifications. This means *more* light, *better* light at no more than the cost of ordinary fixtures.

module is newest, finest

And there's nothing in lighting that will *stay* newer and finer than MODULE. Yes—a MODULE installation remains modern for years, because: it custom-fits and "grows" with every lighting need; it delivers *more* light; its appearance has an undated "always contemporary" look. No ordinary fixtures can match these MODULE advantages.

module installations are never obsolete

No MODULE lighting system is ever obsolete. Here's why: As lighting needs change, more units can be added at any time, at any point in the system—without installing a single new electric outlet box because MODULE units connect together electrically and mechanically. MODULE lighting is never "locked-in"—the "building blocks" of light simply slip into place easily and economically exactly as required.

TELL THIS STORY—IT SELLS

MITCHELL module

REG. U. S. PAT. OFFICE

IF YOU HAVEN'T ALL THE **module** FACTS, WRITE TODAY

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Avenue • Chicago 14, Illinois

Eliminate VOIDS with G&W NOVOID Insulating Compounds

Heavy steel pails permit convenient heating the compound in the pail.

Purpose: Compound is used in potheads, cableheads, boxes and cable joints to fill the internal space with an insulating material which improves the electrical characteristics of the installation. Compound affords some protection against moisture but this is secondary in equipment inherently water and air tight.

Hot compound poured into a device during the original installation vaporizes and expels moisture.

Proper compounding around END of the grounded shielding or sheath of a cable is most important because voids there may result in failure of cable insulation in these zones of greatest electrical stress.

The internal flashover of a cable device is increased by imbedding the cable insulation in compound. Thus shorter creepage paths are permissible with cable in compound than on cable insulation in air.

Essential Properties: Chemically inert, adhesive and "tacky." Low moisture absorption. Low volatile loss. Low dielectric loss and adequate dielectric strength. Suitable melting point *to permit compound to flow into smallest crevices before solidifying.* High flash and fire points *for protection of the handler.*

ASPHALTIC BASE—

NOVOID "A" — *(Medium soft)* — For usual installations of sealed potheads (capnut and disconnecting types).*

NOVOID "C"—*(Medium hard)*—For straight through type potheads having no definite seal. For hot climates and exposures. For cable boxes and splice boxes.

OZITE "B"—*(Medium soft)*—For general use, particularly recommended for cable joints because of its low power factor.

**Novoid "9A" (Very soft) is available for single conductor potheads and spreader head installations on 34.5 kv. and higher voltages.*

OIL INSOLUBLE—

NOVOID "X" has all the properties of other Novoid compounds plus the added advantage of insolubility in mineral oils. It is recommended for use in potheads and cable joints when necessary to avoid troubles due to migration. It has a tendency to "stay-put" because it does not mix with cable oil.

G&W ELECTRIC SPECIALTY CO.

In Canada, POWERLITE DEVICES, LTD., Toronto • 7780 DANTE AVENUE, CHICAGO 19, ILLINOIS

In the News

7000 Attend Cleveland Plant Maintenance Show

The first national Plant Maintenance Show, exclusively devoted to materials, methods and techniques for reducing industrial costs through efficient installation, operation and maintenance, was held in Cleveland's Public Auditorium during the 4-day period of January 16th to 19th. Held conjunctly, a Plant Maintenance Conference presented 22 speakers during six technical sessions, discussing maintenance principles, costs, organization, objectives and procedures. Over 7000 individual registrations were received during the show, with the various conference sessions attracting enthusiastic audiences of from 1000 to 1350 maintenance engineers, electricians, contractors, consultants and company officials. Dedicated to promoting a truer understanding of maintenance as a function of industrial operation, both the Show and Conference stressed practical applications and time-proved maintenance methods. Jointly sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management, the presentation was under the general chairmanship of L. C. Morrow, Co-Editor, *Factory Management and Maintenance*.

Since the Show and Conference followed an across-the-board approach, exhibitions and discussions included not only lighting, electrical distribution, instruments, welding equipment and air conditioning, but heating and ventilating, safety training, materials handling, employee relations, building materials, painting equipment and general services as well. But although planned as an all-inclusive show, nearly 80 percent of the discussions and exhibits directly or indirectly affected the electrical field.

At the first session, devoted to general maintenance principles, C. C. Winston, senior staff engineer for Wallace Clark and Co., New York City, said, "My definition of Preventive Maintenance is the 'anticipation and prevention of breakdowns or major repairs through inspection, lubrication, planning and follow-up'. Fundamental objectives should include: knowing what requires attention, knowing the existing condition of that equipment, having a job order system for requesting and authorizing work, planning the work for each mechanic each day, sizing your maintenance force to the job at hand, knowing your costs by job order, knowing your costs by item of equipment, sizing your maintenance stores on estimated usage, paying your maintenance people adequate salaries and wages, and insuring top-level interest by adequate executive reports."

DAKOTA CONTRACTOR OFFICIALS ***at meeting of South Dakota Electrical Contractors Association, Huron are: (L to R) Clyde Kieley, president, North Dakota State Board of Electricity and vice-president, Midwest Electrical Council; Wayne True, vice-president, South Dakota Electrical Contractors Association; Gordon Tucker, manager, Midwest Electrical Council; Berger Indseth, president and E. M. Lothrop, secretary-treasurer of the South Dakota group; and Wes Severson, vice-president, North Dakota Electrical Contractors Association.***

On the same general subject, John B. Whitlock, general maintenance engineer, Armco Steel Corp., Middletown, Ohio, added, "No longer can the maintenance man be expected to be a jack of all trades. He must be a specialist, an expert in his field. We have found that the best method of organization is to provide an organization whose responsibilities are divided into three groups: field (confined to routine maintenance of an assigned field or area), shop or trade group (such as structural, carpenter, machine), and power (steam, water, compressed air, electric power)." In summarizing, Mr. Whitlock stated, "The solution of today's maintenance problems lies in: an efficient, well organized crew of skilled employees; a program of procedures based upon an intimate knowledge of the condition of the equipment resulting from a sound inspection system; a program of material application study that will embody a study of material failures together with a constant search for new and better materials; a program of controlled lubrication that employs the best in materials applied in the most efficient and carefully supervised methods; and a sound personnel training program under trained leadership that offers courses to the employee."

At the second technical session, discussing the costs of maintenance, James E. Sutherland, vice president, MacDonald Bros., Detroit, stated the facts that, "American industry spent over 8.6 billions of dollars on maintenance and repairs during 1948, a year when profits rose to an all-time high of 21.2 billions. The pressure for production during the war years resulted in considerable deferred maintenance. Industry must be profitable to earn funds for plant improvement."

Albert Ramond, president, Albert Raymond and Associates, Chicago, added, "The practical answer to work measurement for maintenance is to record the work as it develops and to have enough basic data on fractional, elementary operations so that the values corresponding to the various elements of the work can be assembled as the work is done. Once a complete set of basic values has been established, the same values or slightly adjusted values can be used in almost every case."

Tuesday morning's session was launched by R. M. Smart, division engineer, lighting products division, Sylvania Electric Products Inc., Cleveland, who discussed the Selection and Upkeep of Lighting Equipment. He pointed out that, "In general, as quality of light is increased, less time is required for seeing, small objects appear larger, the speed of moving objects appears to decrease and greater contrast results. For many years, quantity of light, often referred to as illumination level or illumination intensity, was the primary consideration

R&S

DELAYED ACTION
PLUG RECEPTACLES
Type EFS

Complete Line
EXPLOSION-PROOF
Class I, Groups C & D

Meet ALL Standards PLUS

NO CONDUIT SEAL required for flush or surface mounted units.

FLOATING CONTACTS – precision machined – provide automatic alignment between mating parts.

HIGH ARC RESISTANT molded interiors . . . for 3 or 4 pole service.

POLARIZED Assembly and Operation – impossible to assemble units in any but correct manner.

ENCLOSURES with external lugs for mounting.

INTERCHANGEABLE Gang Form Assemblies and combinations with other EFS Type devices.

DOUBLE HINGED FLAP lays flat against flush cover when opened.

GAGE PLATES furnished with all flush units to insure correct setting of boxes.

DEPENDABLE OPERATION insured by 48 years of design and manufacturing experience.

Write for catalog H47-4

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Precision-Built Electrical Equipment
125 BARCLAY STREET, NEW YORK 7, N. Y.

SINCE 1902

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AUDIBLE SIGNALS

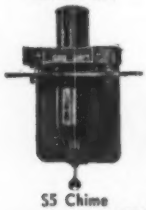
BELLS • CHIMES • HORNS

Single stroke Bells for multiple or series circuits. Vibrating Bells for operation in multiple only. 4" to 20" sizes, indoor and outdoor.

Special tone Signals: musical and soft tone Bells, Chimes, Cow Gongs, Horns and Whistles.

Also contactless vibrating and explosion-proof Bells.

Outdoor Bell

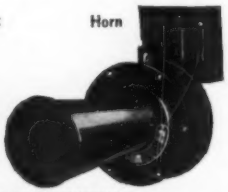


S5 Chime

Sold by Leading Distributors

WRITE FOR 32-PAGE CATALOG

Horn



RELAYS • SIGNALS • CODE CALL AND FIRE ALARM SYSTEMS

Wheelock SIGNALS
SIGNAL
ENGINEERING & MFG. CO.

NEW OFFICERS *of Cook County Electrical Contractors Association, Chicago, are: (L to R) Treasurer—Erwin Kaufmann, Kaufmann Electric Co.; president—Leo Witz, Continental Electrical Construction Co.; vice-president—Frank Block, Block Electric Co.; secretary—Abe Sluis, Sluis Electric Co.—all of Chicago.*

in judging a lighting system, but after considerable study and tests, it was found that the design of a lighting system should go beyond the consideration of lighting quantity alone." In developing this statement, Mr. Smart analyzed the physical characteristics of the area to be lighted, the selection of light sources and lighting equipment, the cost of lighting and preventive maintenance.

Upkeep, Controls and Distribution Equipment was the topic for H. E. Hardenbrook, general works engineer, Buick Motor division, General Motors Corp., Flint, Mich. Stating that, "There is an old axiom, 'plan your work and then work your plan'", he mentioned the importance of records, schedules and competent maintenance personnel. Pertaining to motors, Mr. Hardenbrook remarked that, "there should be a regular schedule for inspection of bearings, insulation tests, alignment inspection, load tests and so on. The ambient temperature may be the deciding factor for the lubricant to use. The type of load, whether reversing or plugging, may decide the type of insulation. The motor construction may decide the frequency of inspection." After discussing controls and distribution equipment, he concluded, "Good housekeeping doesn't necessarily mean sweeping the floor and cleaning the windows. It means inspection, lubrication, organized activities that will prevent failure of equipment, and many other preventive measures necessary to keep production rolling out the shipping room door."

Stressing the importance of Using Electrical Instruments in Maintenance, R. J. Teetsell, meter division instrument specialist, Westinghouse

They're moving plenty of furniture

in Tacoma since relighting with Litecontrol

. . . And no wonder, with their merchandise displayed in so well-lighted an area. Note the evenness of the illumination . . . the absence of harsh shadows . . . the ease of seeing . . . all of which make a good lighting installation.

Proper optical relationship of lamps to the Holophane CONTROLENSES* ensures this correct light distribution. The No. 9124 fixture can be used, as in this Tacoma store, with incandescent lens boxes for accent lighting . . . in runs of any length . . . or in rectangles, angles, or crosses. And its smooth, graceful lines and shallow recess depth are advantages to consider for any modern architectural design.

Other features are the flexibility of mounting, easy cleaning, easy relamping. Available in two or three lamp models and with 75 watt slimline lamps. Write today for information and assistance in solving your lighting problems.

Installation: Rhodes Brothers, Tacoma, Wash.
Architects: Mack & Morrison, Tacoma
Electrical Engineers: Beverly A. Travis & Associates, Seattle
Electrical Contractors: The Electric Construction Co., Tacoma
Distributor: Westinghouse Electric Supply Corp., Tacoma
Lighting Equipment: 2 Litecontrol No. 9124 curved-lens fixtures in combination with 1 incandescent lens box per run
Lamps per fixture: No. 9124 fixture — 2-40 watt fluorescent, lens box — 1-300 watt incandescent
Watts per fixture: No. 9124 — 100 watts, incandescent — 300 watts
Area Lighted: 74 feet by 120 feet
Footcandles: 50 in service (average)

Write for New Booklet!

Contains: Pictorial Index for easy, quick reference. Complete descriptions and specifications on all Litecontrol fixtures, including utilization factors, formulae and all data necessary to figure an installation from start to finish.

LITECONTROL
Fixtures
KEEP UPKEEP DOWN

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

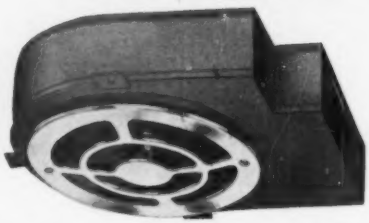
*® HOLOPHANE CO., INC.

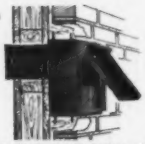
LITECONTROL CORPORATION
36 Pleasant Street, Watertown 72, Massachusetts

Please send me a copy of your new booklet.

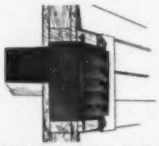
Name ..... Title .....
Company .....
Street .....
City ..... State .....

10" BROAN MOTORDOR CEILING FAN . . . .

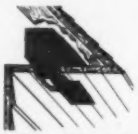




No. 410 Motordor Wall Cap with insulated door fitting tightly against rubber gasket. Door is opened by a special damper control motor. No back drafts—no noisy dampers—bugs, birds can't enter.



No. 420 Wall Cap less costly than No. 410. Provides weather protection through louvres and a back draft damper which can be easily removed for cleaning the duct.



No. 430 Elbow designed for homes where eves are on the same level or lower than joists. Grille for opening available at slight additional cost.

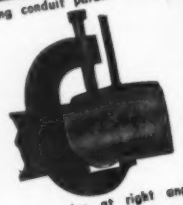
THREE wall caps provide easy solution to all installation problems. This fan has positive ventilating action. All the air is discharged into the duct. Large openings in chrome plated grille allow free passage of air. Easily installed between ceiling joists. Uses standard 3¼" x 10" heat duct. Air delivery 400 C. F. M. Motor is shaded pole type, fully enclosed, 1/40 h.p.—115 volt, 60 cycle, 1500 r.p.m. The grille, fan motor, and damper are easily removed for cleaning. The wall caps have mounting lugs which provide for quick and rigid fastening to sheathing.

Write for bulletin which gives full details on our complete line of fans.

Broan
MFG. CO., INC.
1669 N. WATER ST. MILWAUKEE 2, WISCONSIN

"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

Supporting conduit parallel to beam.



Supporting pipe at right angle to beam.

For Non-Slip Support of Conduit—At Any Angle

"EFFICIENCY"
Conduit Hanger
Type F

Write for Catalog 38-A

Type F Efficiency Conduit Hangers . . . with radiating ridges and five point gripping surface . . . carry pipe or conduit at any angle to beam on true mechanical principle. Made in ½" to 2½" diameter, for all open steel construction requirements. Write today.

Efficiency ELECTRIC AND MANUFACTURING CO.
East Palestine, Ohio

Electric Corp., Pittsburgh, stated that, "Proper instrumentation not only serves as a guide to the operator for production purposes, it also tells him that the equipment is operating normally or abnormally, or whether the equipment should be inspected or repaired. Even if the equipment is protected by overload devices, why wait until they have to operate when a wattmeter or an ammeter can tell in advance that for some unknown reason the load has been increased or that one winding of a 3-phase motor is open. Industry uses more electrical instruments today than ever before, and is continually finding new and important applications, resulting in better control, more economical use of power and a production of high grade products with a minimum of attention. Instruments are the eyes of industry."

One of the discussions during the Tuesday afternoon session was also of interest to electrical men, for C. E. Egeler, illuminating engineer, General Electric Co., Nela Park, analyzed The Relationship of Lighting and Color to Production. He emphasized that, "Color and good lighting are partners in producing seeing conditions which stimulate high industrial production. Lighting has grown from the specification of footcandles to the addition of quality requirements. These involve not only the use of source sizes and locations to reduce direct and reflected glare, but also specifications for the brightness and color of the surroundings of the task, both the immediate background and more distant walls. Among the more important features of light and color in a factory related to plant operation are: easier seeing, choice of color combinations, color of light sources, more efficient lighting, employees' health and morale, good housekeeping, accident reduction, improved quality of work and the functional uses of color."

NISA Program

Preliminary schedule of the June National Industrial Service Association convention in Boston has been announced as follows:

Sunday, June 4—Registration and President's Reception.

Monday, June 5—Opening session and technical papers.

Tuesday and Wednesday, June 6 and 7—Open forums and selection of shop visitations.

Entertainment will include the famous "Pops Concert" in Symphony Hall. A program for the ladies has also been arranged under the direction of Mrs. Alfred Elson.

G.E.'s 9574 all-purpose* insulating varnish provides

BETTER BONDING
BETTER PENETRATION
NO SLUDGING

Mr. Guy W. Probst

That's what Guy W. Probst, owner of the Lockhaven Electric Repair Co., Lockhaven, Pa., says about General Electric's 9574. Here is his statement:

> *"G-E all-purpose insulating varnish 9574 gives you a cover coat you can see and that fills up between the Formex wires. I've had very good success with it on armatures up to 2000 RPM. On formed coils I can bake before forming and the turns don't come apart when you pull the coil. I've had no trouble with sludging, and all my work is hot dipped. I find that I only use about half as much 1201 Glyptal as a cover coat on 9574 as I had to use over the varnish I had been using, and I get higher gloss and better bonding when 1201 is used over 9574."*

**G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G.E.'s complete line of electrical insulating materials, including adhesives, wedges, cements, compounds, cords and twines, sleeving, wire enamels, mica, papers and fibers, permafils, tapes, tubing, varnished cloths, varnishes.*

EASY TO USE

BAKES AT LOWER TEMPERATURES than is possible with most other synthetic varnishes.

PENETRATES EASILY into the deepest coils.

NO SPECIAL THINNER required (just petroleum spirits).

STABLE—will not tend to harden in the tank.

SEND FOR BULLETIN!

If you haven't yet tried G-E 9574, get in touch with your local G-E Distributor, or write for our new bulletin to Section K-2, Chemical Department, General Electric Company, Pittsfield, Mass.

You can put your confidence in

GENERAL ELECTRIC

CD50-K2

READINGS AT A GLANCE

for BOTH AC and DC

Instant Current Measurements Without Breaking Circuit or Insulation . . .

You can read 'em fast and accurately with the Columbia Tong Test Ammeter by merely clamping the tongs around the electrical conductor. Tong Test is the only instrument of its type that can measure both AC and DC. Cannot burn out for it has no windings. Safe, convenient and light in weight. Interchangeable scale ranges up to 1000 amperes. Five types to accommodate cables up to 3⅞", bus bars up to 4½" x ½". Voltage readings, too, with the Voltor Attachment.

Write for Tong Test Bulletin CM-400

COLUMBIA ELECTRIC MFG. CO.
4541 Hamilton Ave., Cleveland 14, Ohio

ILSCO LUGS

CONNECTORS—ACCESSORIES

Industry's Standard of Excellence

ABOVE ALL . . . in performance
BELOW ALL . . . in heat rise

Yes, here's really something to brag about . . . and proved by innumerable tests in laboratories and the field.

ILSCO LUGS average over 50% COOLER than Underwriters' requirements

That means greater economies in every way . . . and greater satisfaction.

VT series available in 6 sizes from #14 wire to 600,000 CM.

WRITE for 80-page Manual

ILSCO

COPPER TUBE & PRODUCTS, Inc. CINCINNATI 27, O.

Anderson, Johnson Head Twin City Groups

Annual elections of officers for the Twin City electrical contractor associations resulted in the following slate for 1950:

Minneapolis—Don Anderson, Parsons Electric Company, is the new president of the Minneapolis Electrical Contractors Association. Other officers include: vice-president—Wm. S. Collins, Sr.; treasurer—A. W. Strohmeier. Directors of the association are: O. H. Batzli, John Kvalsten and Dewey Wallin. Representing the group on the Midwest Electrical Council are: Don Anderson, Fred Garling and Foss Poole.

St. Paul—Re-elected as president of the St. Paul Electrical Contractors Association is Felix Johnson, Pioneer Electric Company. Assisting him in official capacities are: vice-president—William A. Muska; secretary-treasurer—Leonard Anderson. Directors are: William Collins, Harry Fry, Ben Padwal, Ralph Stapp and John Kostka. Representing the association on the Council are: Edward Hoffman, Felix Johnson and W. A. Muska.

Curtis W. McGraw Heads McGraw-Hill

Curtis W. McGraw was elected Chairman of the Board and President of McGraw-Hill Publishing Company, Inc. on February 24, 1950, succeeding James H. McGraw, Jr., whose resignation was accepted with deep regret by the Board of Directors. Mr. McGraw, Jr., had resigned in order to be relieved of executive responsibility and to seek needed rest.

Willard Chevalier was appointed to the newly created post of Executive Vice President. Joseph A. Gerardi succeeds Curtis W. McGraw as Treasurer.

Braun Appointed to Minn. State Board

Ray F. Braun, chief electrician of the Jacob Schmidt Brewing Company of St. Paul, Minn., has been appointed executive-secretary of the Minnesota State Board of Electricity, effective January 1, 1950, to fill the vacancy created by the death of George Garney last June.

A native of St. Cloud, Minn., Mr. Braun followed one year of college with a five-year evening course in electricity at Dunwoody Institute, Minneapolis. As a journeyman electri-

Inside wall ▸ or ceiling ◂ . . .

It's all the same to Blo-Fan*

COMBINATION FAN AND BLOWER

The versatile Blo-Fan is designed for installation in the most convenient, efficient spot above the point of air pollution . . . It can be installed in an inside wall without sacrificing valuable cabinet space . . . *However, ceiling installation is recommended because the Blo-Fan is well above head height where it captures ALL the odors, steam, grease and smoke* . . . Blo-Fan requires only 3½ inches above or behind the plaster where it fits between standard joists or studs . . . Ducts are run thru roof or outside wall . . . ***And remember this, only Blo-Fan has the patented blade which combines the power of a blower with the volume of a fan . . . Only Blo-Fan has the nine-position control switch which permits operation at the exact speed required by the degree of air pollution.***

A postcard will bring you complete details and the name of your nearest distributor.

Stocked by more than 500 wholesalers in over 350 cities.

Factories: Pomona, California; Newark, New Jersey
Warehouses: Los Angeles, San Francisco, Chicago

PRYNE & CO., INC., Box E-3, Pomona, California

Manufacturers of Pry-Lites—the modern recessed lighting fixtures with snap-on fronts.

*Trade Mark Reg.

Blo-Fan

OFFERS 4 OPPORTUNITIES FOR INCREASED PROFIT

Home owners know that Blo-Fan ventilation keeps homes clean—cuts redecorating costs.

Put them where they're needed!

KITCHEN

BATH

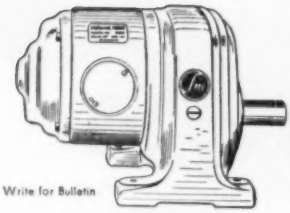
GAME ROOM

LAUNDRY

Cash in on owner demand with Blo-Fan Spot Ventilation at the Point of Air Pollution

The Key to production problems

Open the door to greater production with Sterling Slo-Speed electric power drives.



STERLING ELECTRIC MOTORS

Write for Bulletin

Plants: New York • Los Angeles • Hamilton, Canada
Offices in Principal Cities

SLO-SPEED (Geared) • SPEED-TROL (Variable Speed) • KLOSD (Normal Speed)

The Heavy-Duty "Badger"... A BETTER-BUILT Switch

• **All time switches are *not* alike. In the Reliance "Badger", arcing between contacts is eliminated, and objectionable sound level is reduced to a minimum. Extra heavy gears, a slow-speed synchronous motor, and heavy copper-to-copper, self-adjusting "floating" contacts—all help to make the Reliance "Badger", a better-built switch for long-lasting, accurate control. For complete information, write—RELIANCE AUTOMATIC LIGHTING CO., 1937 Mead Street, Racine, Wisconsin.**

RELIANCE TIME SWITCHES

cian, he worked for three years for the Northern States Power Company in St. Cloud; then worked as electrician for the Commonwealth Electric Company, St. Paul electrical contracting firm, prior to his employment at the brewing company. At present, he is teaching electricity two nights per week at the St. Paul Vocational High School.

Dates Ahead

National Electrical Manufacturers Association—Edgewater Beach Hotel, Chicago, Ill., March 13-16.
Illuminating Engineering Society—Pacific Northwest Regional Conference, Edmond Meany Hotel, Seattle, Wash. March 23-24.
American Society of Tool Engineers—Industrial exposition, Convention Hall and Commercial Museum, Philadelphia, Pa., April 10-14.
Chamber of Commerce—38th Annual meeting, Washington, D. C., May 1-4.
National Fire Protection Association—54th Annual Meeting, Haddon Hall, Atlantic City, N. J., May 15-18.
National Industrial Service Assn.—Annual meeting, Boston, Mass., June 5-7.
National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., June 12-16.
New York State Association of Electrical Contractors & Dealers, Inc.—Saranac Inn, Saranac Lake, N. Y., July 1-8.
International Municipal Signal Assn.—55th Annual convention, Hotel Commodore, New York, N. Y., Sept. 18-21.
Canadian Electrical Manufacturers Assn.—Annual meeting, General Brock Hotel, Niagara Falls, Ont., Sept. 27-29.
National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., Nov. 13-16.

Manufacturers News

SYLVANIA CHANGES

The California sales division of Sylvania Electric Products Inc. has been reorganized into two separate divisions in order to coordinate sales and warehouse activities in each area.

It is to be known as the Central Pacific Division, with headquarters in San Francisco, and the South Pacific Division, with headquarters in Los Angeles. The Northwestern division, headquartered in Seattle, will remain in operation to service that section of the country.

Robert C. Harper, formerly a member of the Los Angeles sales office, has been appointed division sales manager of lighting products for the Central Pacific division. Charles I. Brady, formerly supervisor of commercial engineering for lamps, has been named to the same position in the South Pacific division.

The appointment of George C. Connor as general sales manager for the Photoflash Division and Alfred C. Viebranz as general sales manager of the Electronics division of Sylvania has been announced.

James F. Davis has been named district sales manager of the New Jersey area for Sylvania.

E. Gayle Fitzsimmons has joined Sylvania to head the company's employee communications activities.

are businessmen

COLD-BLOODED?

OF COURSE NOT! Literally, their normal body temperature is 98.6—same as laborers, engineers or any other group of people. And, figuratively, they're no more, or no less, cold-blooded—as a group.

We all know unreasonable generalizations can be dangerously false. Common sense and on-the-job experience show us the value of dealing specifically with ideas, problems—and *people*.

Let's not make the big—and costly—mistake, then, of generalizing on religious or racial groups. Adopt and *carry out* these common sense principles:

1. Accept—or reject—people on *their individual worth.*
2. Don't listen to or spread rumors against a race or a religion.
3. Speak up, wherever we are, *against* prejudice. Work for understanding.

A PUBLIC SERVICE PROJECT ★ THE ADVERTISING COUNCIL ★

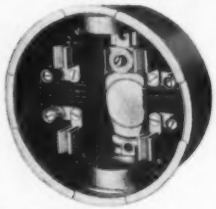
Published in the public interest by:

McGraw-Hill Publications

IT'S EASY TO INSTALL

STANDARD METER SOCKETS

* Roomy wiring space for higher rated conductors
* One-piece snap-action stainless-steel sealing ring—no tools required
* Permanent dimensions with die-cast base



TYPE R1 SINGLE-PHASE METER SOCKET

Not only is the standard G-E meter socket easy to install—it's easy to stock too. One catalog item covers the widest practicable range of meter ratings.

Where the maximum rating of the standard socket is not enough, choose the new G-E high-capacity socket. It can be used with conduit sizes up to 2½ inches, cable sizes up to 4/0.

Detailed data available from your G-E representative. Let him help you. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

691-34

FRIGID

KEEP AIR FRESH AND CLEAN FANS

The "FRIGID" line of ventilating equipment, including blowers, exhaust fans, spray booth fans, attic fans, etc., is especially recommended for use in plants and factories which operate under conditions requiring year round ventilation.

Follow up these factories in your territory—tell them — sell them "FRIGID" — it means "bonus" profits for you from these sources which might ordinarily be overlooked.

See Your ELECTRICAL DEALER

CIRCULATORS & DEVICES MFG. CORP.

128-168 Thirty Second Street • Brooklyn 32, N. Y.

GRAYBAR CHANGES

The Southwestern district of the Graybar Electric Company with headquarters at Dallas has been divided into two separate units with office of the newly created district, to be called the Gulf Coast District, at Houston. Both districts will continue to operate under the supervision of district manager G. T. Marchmont.

Branch houses reporting to Houston under the new set-up will be Beaumont and Corpus Christi, Texas; New Orleans, La.; and Jackson, Miss. Branch houses which will continue to report to Dallas are San Antonio, Fort Worth and Amarillo, Texas; and Shreveport, La.

J. E. Fontaine, present Houston manager, has been made assistant district manager in charge of the new district. A. W. Palin, present operating manager at Houston, has been made district operating manager for Houston and its branches and R. B. Hamilton, present Houston credit manager, will be the new district's credit manager.

District appliance sales manager V. A. Elmblad, of Dallas, has been appointed assistant district manager of the Dallas district reporting to Mr. Marchmont. District operating manager N. M. White and District credit manager W. F. Gay of the Dallas District will continue to serve in their present capacities.

The sub-warehouse at Austin, Texas, will be made a regular branch with E. L. Copeland, sales manager in charge, reporting to Dallas.

F. P. Hoeffler, former acting district operating manager for Graybar in Minneapolis, has been appointed district operating manager at Pittsburgh.

WESTINGHOUSE CHANGES

Burt S. Burke has been appointed manager of the lighting division of the Westinghouse Electric Corporation at Cleveland, Ohio. Mr. Burke was formerly manager of the company's switchgear distribution apparatus department at East Pittsburgh, Pa.

S. F. Davies, Jr. has been appointed manager of the commercial, industrial and floodlighting section of the lighting division.

Three new sales divisions of the Middle Atlantic district of the Westinghouse Lamp Division have been formed.

Harry A. Croasdale has been named manager of the Penn-Jersey lamp sales division, which includes eastern Pennsylvania, south Jersey, Delaware and the eastern shore of Maryland.

Edward S. Barrington has been appointed manager of the Chesapeake lamp sales division with headquarters in Baltimore, Md. This division includes the remainder of Maryland, northern Virginia, eastern West Virginia, and the District of Columbia. Mr. Barrington was formerly lamp

manager for the Philadelphia metropolitan area.

The Virginia lamp sales division, with headquarters in Richmond, Va., will be headed by John C. Downing. This area includes lower belt Virginia, northeast North Carolina, southern West Virginia, eastern Kentucky and eastern Tennessee.

The establishment of three new sales units within the Central district, Westinghouse Lamp, has been announced. Ray C. Daugherty has been appointed manager of the Pennsylvania-Ohio division, which includes western Pennsylvania, eastern Ohio, and northern West Virginia. Harry A. Kinley has been named manager of the Michigan division, serving northwestern Ohio and all of Michigan except the upper peninsula. Howard J. Thomas has been appointed manager of the Ohio Valley division, including southern Ohio, western Kentucky, and southern Indiana.

Harold W. Larson has been appointed manager of a newly-created Omaha lamp sales division, including Iowa, Nebraska, Rock Island County in Illinois and most of South Dakota.

Ralph R. Cheney has been appointed manager of a newly-created Milwaukee lamp sales division.

F. H. Clark has been named sales manager for the standard control division of the Westinghouse Electric Corporation at Beaver, Pa.

PRODUCTS APPOINTMENTS NATIONAL ELECTRIC

J. Sterling Davis has been elected treasurer and a member of the board of directors of National Electric Products Corp., Pittsburgh.

Earl M. McCabe is a new sales representative throughout Ohio for the electrical raceways and busways manufactured by National. Mr. McCabe's headquarters are at 1836 Euclid Ave., Cleveland.

James C. Shearer has joined the sales staff of National and will cover the southern counties of Ohio. Mr. Shearer's headquarters are in the Enquirer Bldg., Cincinnati.

FAIRBANKS-MORSE CHANGES

Several changes in the sales organization have been announced by Fairbanks Morse & Co. They are as follows:

J. A. Cuneo, formerly branch manager, Los Angeles, Calif., has been transferred to Chicago to assume the duties of manager of the company's Chicago Branch. A. M. McLaren succeeds him as Los Angeles branch manager.

John S. King, formerly manager of the Chicago branch, has been moved to Cincinnati, Ohio as branch house manager of that sales area. He succeeds J. S. Peterson who has been trans-

CPC PLASTIC CLAMPS

"HOLD EVERYTHING"

LONGER • BETTER • SAFER

NON-CORROSIVE STRAP

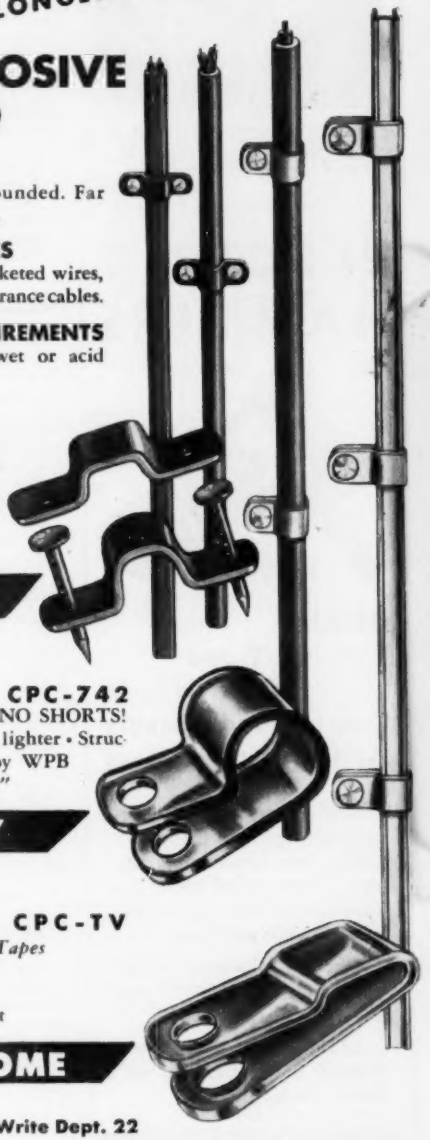
NO CUTTING EDGES
Thick, pliable. Edges rounded. Far safer if sway or vibration.

FOR ALL TYPES WIRES
Cables, cords, neoprene jacketed wires, romex, telephone, radio entrance cables.

COMPLIES REA REQUIREMENTS
Non-corrosive strap all wet or acid locations

Especially barns

on the FARM



21 SIZES ORDER CPC-742
Safer, Enduring Support. NO SHORTS! NO CORROSION! Safer • lighter • Structurally stable. Endorsed by WPB for Govt. Sizes ⅛" to 1¼"

in INDUSTRY

TV ....ORDER CPC-TV
Perfect control of lead-in Tapes
Only 1 Nail or Screw
Weatherproof
Tough, Pliable, Permanent

. . for the HOME

Write Dept. 22

COMMERCIAL PLASTICS CO.

Merchandise Mart • • • Chicago 54

SYNTRON

DEPENDABLE

ELECTRIC HAMMERS

**DRILL–
CUT and
CHANNEL in
Concrete and Masonry
IN 1/10th THE TIME**

3600 powerful blows per minute really speed up the work—drilling holes for anchoring conduit — cutting and chipping openings through concrete and masonry walls and floors.

4 models—with maximum capacities of ⅜", 1⅛", 1½" and 2"—for A.C. operation.

Also, self-rotating Electric Hammer Drills for drilling hundreds of holes per day.

Write for catalog data.

SYNTRON CO.

690 Lexington Homer City, Pa.

ferred to Chicago and will be attached to the sales manager's office.

William H. Kingsley, who has for the past 12 years been district manager of the New York office of the Ideal Electric & Manufacturing Company, has joined the Fairbanks-Morse organization to become manager of the electrical division, with headquarters in the company's executive offices in Chicago.

J. C. Emburg, who has for the past three years been manager of the Atlanta branch, has been transferred to Portland, Ore., where he has assumed the duties of branch manager, succeeding Howard Oxsen. Mr. Oxsen is returning to San Francisco to be manager of Diesel engine sales in that area.

George A. Hawkins has been appointed manager of the Atlantic branch. Mr. Hawkins has, for the past several years, been manager of the company's sub-branch at Minneapolis.

WESCO APPOINTMENTS

Z. W. Pique has been appointed manager of the Washington, D. C. branch of the Westinghouse Electric Supply Company, succeeding S. N. Smart, who is leaving the company because of ill health. Prior to this appointment, Mr. Pique was manager of the Wesco Johnstown, Pa., branch, in which capacity he will be succeeded by L. I. Haller, formerly Wesco East Central district assistant apparatus and supply sales manager at Pittsburgh.

Joseph N. Stapleton has been named manager of the Hempstead, Long Island branch.

Russell N. Chapman has been named manager of the Providence, R. I., branch. Prior to this appointment, he served as Wesco General Farm sales manager at the company's executive headquarters, New York City.

Wallace C. Busbin has assumed the duties of Carolinas District lamp supervisor, with headquarters at Charlotte, N. C.

In addition to his present duties as manager of the Syracuse branch, W. D. Frick has been appointed manager of the Watertown branch.

LINE MATERIAL CHANGES

The Line Material Company, Milwaukee, Wis. has announced the appointment of Nicholas Delaney to the newly-created post of manager of construction materials sales. He has served as sales manager for Line Material's Kyle Products plant since 1947.

Richard Kirk succeeds Mr. Delaney as manager of Kyle products sales, South Milwaukee, Wis.

The Line Material Company, a division of McGraw Electric Company has announced that three of its subsidiaries have been dissolved as individual cor-

Make PERMANENT Connections *Quickly*

This big, strong, heavy duty Sherman Solderless Lug is a favorite everywhere. It's easy to install, and it makes an efficient, permanent connection. Extra thread plate for strength. Floating pressure pad attached to screw. Serrated gripping surfaces. Sizes up to 500m CM. Write for catalog!

H. B. Sherman Mfg. Co.
Battle Creek, Michigan

Sherman
SOLDERLESS LUGS

ROBOT OPERATORS

Electronically
**OPEN,
CLOSE
and LOCK
DOORS, GATES, Etc.**

RESIDENTIAL
COMMERCIAL
INDUSTRIAL

*THOUSANDS IN USE . . .
MANY OVER 20 YEARS*

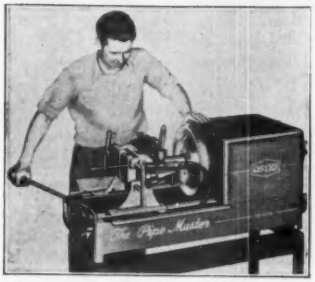
APPROVED BY UNDERWRITERS LABORATORIES, INC. | NATION-WIDE DISTRIBUTION AND SERVICE

ROBOT Dealer Franchise offers unusual year 'round profits

Write today for details to Dept. - ECM

Manufactured By:
ROBOT APPLIANCES, INC.
13165 Prospect Ave. · Dearborn, Mich.

4 Keys to PROFIT$

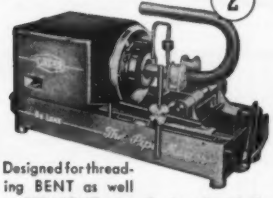


No. 522 "Pipe Master" DE LUXE

1 — A fast, accurate pipe threading machine. Quick-opening, adjustable, floating-type die-head. Aluminum construction. Standard range ¼" to 2" pipe. Extra range ⅛" pipe. *The "TOPS" for VALUE!*

No. 552 "Pipe Master" DE LUXE ROTARY

2



Designed for threading BENT as well as STRAIGHT pipe. Equipped with Revolving Die-Head and Open Type Vise. Otherwise same construction and same range as the No. 522 machine.

No. 502 "Pipe Master" STANDARD

3 — The original "Pipe Master" with new features. Steel construction. Same type of stationary die-head and same range as the No. 522 machine.

No. 532 "Pipe Master" STANDARD ROTARY

Same construction, same range as the No. 502 "Pipe Master" but equipped with Revolving Die-Head and Open Type Vise for threading BENT as well as STRAIGHT pipe.

4

Write for ALL the facts NOW!

Ask for the "PIPE MASTER" catalog. Get the jump on your competition! Select the "PIPE MASTER" best suited to YOUR needs!

THE OSTER MANUFACTURING CO.
2081 EAST 61st STREET
CLEVELAND 3, OHIO, U. S. A.

porations and will now be known as divisions of the McGraw Company. The firms affected are: Line Material Sales Corporation of New York, Oneida, N. Y.; Line Material Company of Pennsylvania, East Stroudsburg, Pa. and Southern Line Material Company, Birmingham, Ala. There will be no changes in personnel or nature of products.

GENERAL ELECTRIC CHANGES

Martin L. Sloan, vice president of the General Electric Company with headquarters at Nela Park, Cleveland, has retired under the company's pension program after nearly 40 years of service.

Dr. Matthew Luckiesh, director of G.E.'s Lighting Research Laboratory at Nela Park for the past quarter century, has retired. Dr. Luckiesh intends to conduct his private practice in lighting consultation from his residence in Shaker Heights, Ohio.

The retirement after more than 40 years service of N. H. Boynton, sales consultant in the administrative staff of G.E.'s Lamp Department at Nela Park, has been announced.

Harold D. Blake, technical director of the Lamp Development Laboratory at Nela Park has retired after 40 years of continuous service.

Retirement of Donald H. Wyre, manager of the Allegheny sales district of G.E.'s Lamp Department and appointment of Warren P. Thayer as his successor, has been announced.

Dr. Zay Jeffries, vice president of General Electric Company in charge of the chemical department has retired.

Dr. Albert W. Hull, assistant director of the G.E. Research Laboratory at Schenectady has retired. Dr. Hull will continue to act as a consultant for the G.E. Research Laboratory.

Fred F. Harroff, general manager of the G.E. Lamp Department, Nela Park, Cleveland, has been elected a vice president of the company by the board of directors. Mr. Harroff, who will retain his position as general manager of the Lamp Department, succeeds Martin L. Sloan.

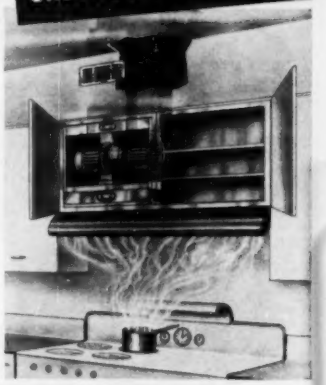
The apparatus agency division of G.E.'s Industrial Divisions has been replaced by a newly-organized agency and distributor division. George L. Irvine has been appointed manager of the new division, and R. D. Moore has been named assistant manager. They will be responsible for the sale of all G-E apparatus Department products through agents and to distributors, wholesalers and dealers.

J. Russell Watt has been appointed sales manager of industrial laminates and insulating materials for the Chemical Department of G.E. with headquarters at Coshocton, Ohio.

The appointment of James D. Lowe as wire and cable specialist has been announced. Mr. Lowe has been assigned to the Department's New York District and will make his home office at the Bridgeport plant.

The most MODERN kitchen ventilating system

TRADE-WIND
SUPER CLIPPER
CABINET VENTILATOR



Installs in cabinet over range... double inlets provide COMPLETE ventilation

Only the Super Clipper Kitchen Ventilating System—made by Trade-Wind—exhausts cooking fumes and heat from *both the stove and at the ceiling level.*

This newest development is installed in metal or wood cabinets directly over the stove.* The twin squirrel cage blowers produce 600 CFM—more than sufficient power to trap all cooking heat, grease and odors from the range top as well as through the second inlet at the ceiling. The motor is equipped with a 2-speed control. Two metal air filters are provided. Both a fold-under hood and stationary hood are available and both are optional.

No other kitchen ventilator can do the *complete* job that the Super Clipper accomplishes. And no other ventilator offers the architect, the builder and the home owner the versatility and efficiency which the Super Clipper provides for the modern kitchen.

*Several manufacturers now build metal cabinets especially for the Super Clipper. Wood cabinets can also be built on the job. Trade-Wind does not provide the cabinet.

Write today for complete information.

TRADE-WIND MOTORFANS, INC.
5709 S. Main St., Los Angeles 37, Calif.

SAVE HOURS ON
CONDUIT AND PIPE
INSTALLATIONS

...with a GREENLEE PIPE BENDER

Cut costs, speed your jobs this efficient, easy, economical way. Make "on the job" bends in pipe and rigid conduit up to 4½", thin-wall conduit and tubing with a GREENLEE Hydraulic Bender. One man operated for fast, accurate, uniform bending. Simple to operate, easy to set up and shift from job to job. Not only saves labor, but eliminates cost of many manufactured bends and fittings. Often pays for itself on first few jobs. Write today for free folder No. E-201.

TOOLS FOR CRAFTSMEN
GREENLEE

Other GREENLEE timesaving tools for industry: Hand Benders for Tubing • Hydraulic Pipe Pushers Knockout Tools • Auger Bits and Drills • Spiral Screw Drivers • Chisels and Gouges • And many others. Greenlee Tool Co., 1743 Columbia Ave., Rockford, Ill.

TRUMBULL APPOINTMENTS

Taylor D. MacLafferty has been named vice-president in charge marketing by the Board of Directors of the Trumbull Electric Mfg. Company of Plainville, Conn. Mr. MacLafferty has been manager of marketing since April 1948.

Frank M. Oglee has been named vice president in charge of employee and community relations. He has been manager since October 1947.

ROME CABLE CHANGES

Rome Cable Corporation of Rome, New York, has announced the appointment of Anton M. Mitrovich as sales representative. Mr. Mitrovich, formerly with General Electric Supply Co., will represent Rome Cable in the Portland, Oregon area.

A new warehouse has been opened at 156 Simpson St., N. W., Atlanta, Ga. The company's Atlanta district sales office will also be located at this address. Both warehouse and sales office will be in charge of C. J. McMurry, district sales manager.

A new warehouse has also been opened in Salt Lake City, Utah, at 230 South Fourth West. H. L. Rawlings is in charge.

WALKER BROTHERS ELECTS OFFICERS

Hervey S. Walker, president of Walker Brothers, Conshohocken, Pa. since 1912, has been elected to the newly created post of chairman of the board.

Anthony M. Callanan, former vice president and general sales manager, becomes the new president. He has been associated with Walker Brothers since 1921.

Other new officers elected at the annual meeting were H. Newton Walker II, vice president; C. A. Dougherty, assistant treasurer; and Rhoda M. Drayer, assistant secretary.

LIGHTING PRODUCTS APPOINTMENTS

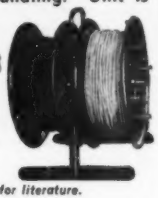
Lighting Products Inc. of Highland Park, Ill. has made the following new territory assignments:

Lon E. Russell of Miami, Fla. will cover the state of Florida; Glenn Arnold, Atlanta, Ga., Georgia and Alabama; Wm. Bracken, Los Angeles, Calif., Southern California territory; George Eberhardt, Buffalo, N. Y., Buffalo and Western New York State; and Electrical Sales Co., New Orleans, La., will cover Louisiana, Mississippi and Arkansas.

HyKon TIME AND LABOR SAVING TOOLS

HYKON WIRE MEASURING UNIT
A complete, compact unit for all wire measuring. Both coils left neat for easy handling. Unit is portable.

HYKON WIRE REELS
Pay out wire fast with no kinks, no tangles and no waste. Easily loaded. Portable.



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HyKon MFG. CO.
STATION A
ALLIANCE, OHIO

K&H Solderless Terminal LUGS
A SIZE and TYPE for every need!
K&H Solderless CONNECTORS

WRITE FOR CATALOG 5LC

KRUEGER & HUDEPOHL
232-8 VINE ST. ★ CINCINNATI 2, OHIO

NEW POSITIONS FOR ROEBLING MEN

E. A. Trask, former head of the San Francisco office of John A. Roebling's Sons Company of California, has assumed his new duties as manager of sales of the company's Chicago corporation. G. C. Bukowsky, former manager of the Portland, Oregon branch, succeeded Mr. Trask.

•

Mitchell Manufacturing Co., Chicago, Ill. has announced the appointment as distributors for Mitchell Room Air Conditioners, Raymond Rosen Company, Philadelphia, Pa.; Arnold Wholesale Company, Cleveland, Ohio; Northeastern Distributors, of Boston, Mass.; Simon Distributing Co., Washington, D. C.; I. Feldman Co., Providence, R. I.; Appliance Distributing Co., Columbus, Ohio; V. J. McGranahan Company, Toledo, Ohio; Southern Wholesalers, Shreveport, La.; and Marlin Associates, Dallas, Texas.

•

Edwards Company, Inc., of Norwalk, Conn. has announced the appointment of John L. Taylor as sales manager.

•

The appointment of George C. **Jelliffe** as eastern district manager for the **Ilg Electric Ventilating Co.** of Chicago has been announced.

•

Silvray Lighting, Inc. has announced the appointment of Earl H. Aik of Milwaukee, Wis. and his associate Robert Aik of Appleton, Wis. as representatives in Wisconsin.

•

American Transformer Company, has consolidated all its operations, including its general offices, under one roof in a new building located at 285 Emmet St., Newark, N. J.

•

The appointment of R. C. Piper, Jr., as sales manager of **La Salle Lighting Products, Inc.** of Buffalo has been announced.

•

The appointment of George L. McKenna as assistant to W. W. Watts, vice president in charge of the **RCA** engineering products department, has been announced. Prior to his appointment, Mr. McKenna was manager of the industrial products section of the engineering products department.

6 important advantages

with Standard TRADE MARK

DRY TYPE TRANSFORMERS

1 — Increased efficiency of lighting and motors; 2 — Low-cost movability for relocation; 3 — Out-of-way installation of small transformers; 4 — Indoor installation of substation sizes; 5 — Less and easier maintenance; 6 — Saving of space and enclosure construction costs.

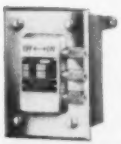
300 KVA dry type. Sizes from 50 VA to 1000 KVA. Special sizes built to specific requirements.

POWER, DISTRIBUTION, INSTRUMENT, STREET LIGHTING AND TESTING TRANSFORMERS — OIL, ASKAREL OR AIR-COOLED

THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO • OFFICES IN PRINCIPAL CITIES

R&S SWITCHES
Type EFS

Complete Line
EXPLOSION-PROOF
Class 1, Groups C & D



Meet ALL Standards PLUS

FLEXIBILITY of outlet sizes and locations, and on the job conduit drilling.

INTERCHANGEABLE gang form assemblies and combinations with other EFS Push Button Stations, Pilot Lights and Manual Starters, etc.

SURFACE AND FLUSH mounting.

EXTERNAL LUGS for mounting.

SILICONE COATED STAINLESS STEEL SHAFTS insure permanent free operation under all conditions of temperature and corrosive vapors.

CORROSION RESISTANT baked enamel finish.

DEPENDABLE OPERATION insured by 48 years of design and manufacturing experience.

Write for catalog H47-4

A8

SINCE 1902

RUSSELL & STOLL COMPANY, INC.
Precision-Built Electrical Equipment
125 BARCLAY STREET, NEW YORK 7, N. Y.

1 MAN CAN DO THE WORK OF A CREW...

with an

Use Electric Tools on Every Job!

Speed the work, cut costs on installation and maintenance jobs. Lightweight Onan air-cooled electric plants supply electric power anywhere for lights, drills, saws, hammers, spades and other motor-driven tools. Equipped with carrying handles or dolly-mounted. Take 'em anywhere and plug in for all the power you need.

SHIPPED COMPLETE READY TO RUN

Gasoline powered models—A. C.: 350 to 35,000 watts. D. C.: 750 to 15,000 watts. *Diesel plants:* 2,500 to 55,000 watts.

Write for Folder

Model 5CK, 5,000 watts D. C. Weighs only 315 lbs.

D. W. ONAN & SONS INC.
3175 ROLALSTON AVENUE
Minneapolis 5, Minnesota

BIGGEST NEW BUSINESS OPPORTUNITY

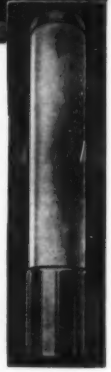
Post-Lites increase business for your customers and for you.

Twelve highly perfected models, meet every outdoor lighting need.

All models bear the complete fixture label of approval of the Underwriters' Laboratories.

Engineered and guaranteed by 38-year old company.

Priced right for popular sale.



Round Units
Half-Round Units
Column Units
Street-Lites
Cluster Lites
Many Adaptations

See your Distributor or Write for Catalog

W. H. LONG CO., 108-114 W. Illinois St., Chicago 10.

Please mail Catalog.

Name .....

Address .....

Roy Dolan is now associated with his father, Frank Dolan, in the Chicago district office of the **Paranite Wire & Cable Division** of **Essex Wire Corporation**, as a salesman.

•

Bulldog Electric Products Company, Detroit, Michigan, has announced that Walter H. Bodle has joined its organization and will function as a specialist on assignments as directed by the sales manager, A. A. Togesen.

•

Slater Electric and Manufacturing Company, Woodside, N. Y. has announced the appointment of Clyde W. Lint as representative in the Chicago and Northern Illinois area, and W. H. Berry, Jr. in the Georgia, Alabama and Florida territory.

•

Karl Lertzman, Hollywood, Calif. has been named electrical wholesaling representative for **General Lighting Company**, for the Southern California area.

•

The Standard Transformer Company, Warren, Ohio, has announced the appointment of A. J. Elggren and Sons Co., Salt Lake City, Utah, as representative covering the states of Utah, Idaho and western Wyoming.

•

William Brand & Company, New York City, has named McKenzie & Shugg, Inc., Pittsfield, Mass. as sales representatives in New England and Eastern New York.

•

D. W. Onan & Sons Inc. has named Frank Gernand of Portland, Oregon as direct factory sales representative covering the entire West Coast and the Territory of Alaska.

•

Bruce S. Williams, formerly manager of the southeast territory, belting division, **Russell Manufacturing Company**, Middletown, Conn., has been appointed assistant to the president.

•

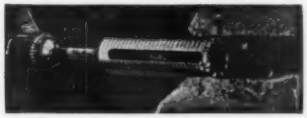
W. H. Welsh has been appointed sales manager of the Systems Apparatus Division of **Sperti Faraday, Inc.**, Adrian, Mich.

•

Eagle Electric Mfg. Co., Long Island City, N. Y. has named Philip Wienick as representative in the Chicago area.

DRILL CONCRETE

2 to 6 inches per minute



WITH THE TILDEN ROTARY KONKRETE KORE DRILL

(driven by ordinary electric drill)

Up to 70% more efficient than pointed or solid drills. Leaves straighter, cleaner holes. Tilden Rotary Konkrete Kore Drill bits are available in sizes from ¼" to 4" diameter. Quotations on sizes from .4" to 8" will be made upon request.

Ordinary pointed or solid drill (left) must drill FULL area of hole. Point of drill acts as a pivot and retards cutting. Only one double cutter gives slow action. Slow-moving ½" center travels at only 13% of most efficient cutting speed.

TILDEN KONKRETE KORE DRILL (right) drills much smaller area of hole. Has no point to retard cutting. All drills have from 3 to 24 cutters depending on size of drill which travel at best cutting speed, give fast, efficient action.

Write for catalog with complete details on this revolutionary concrete drill bit.

DISTRIBUTORS: Inquiries welcomed

TILDEN TOOL MFG. CO.

1995 N. Fair Oaks, Pasadena 3, Calif.

ADVERTISEMENT

FIRST CHOICE...

...For Buying Information

McGRAW-HILL'S PRE-FILED ELECTRICAL CATALOGS is the volume to which Mr. Fred M. Shaw, of Alfred L. Brown Associates, Inc., Worcester, Mass. turns first when he wants up-to-date Buying Information about a wide variety of electrical equipment and supplies. And of this handy book, which is in daily use in his office, Mr. Shaw recently said: *"This Catalog is our first choice in its field."*

Many other businessmen know the practical value of this Catalog and keep it within easy reach of their desks.

If PRE-FILED ELECTRICAL CATALOGS is not available for buying reference at your mill, write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York, N. Y. There is no charge to qualified users.

The appointment of David E. Allen, of New York, as sales manager of the **Anaconda Wire and Cable Company** has been announced. In occupying his newly-created post, Mr. Allen will become assistant to L. R. Love, general sales manager of the company.

•

Automatic Control Co., St. Paul, Minn. has named Lou Hoffman, Albuquerque, New Mexico, as New Mexico area representative, and Dean M. Thomas, Buffalo, N. Y. as Western New York representative.

•

Janette Manufacturing Company, Chicago, Ill. has announced the appointment of W. H. SaLee as general sales manager. He succeeds Harvey Klunder, who recently resigned from the company. Odgen J. Maag will continue as assistant sales manager.

•

The Bryant Electric Company, Bridgeport, Conn., has announced the appointment of Thomas C. Welsh, Jr. as field representative covering the states of Texas and New Mexico.

•

Paul F. Stiller, a former lighting specialist with the West Penn Power Co. in Pittsburgh, has been named manager of the Cleveland office of the **Pittsburgh Reflector Company.**

•

Pennsylvania Transformer Company has announced the appointment of Arnold L. Horelick as engineering manager and John J. Zimsky as chief mechanical engieer.

•

The Bridgeport Brass Company has moved its warehouse facilities from Newark to a new location at Hillside, N. J. The new warehouse is in charge of N. H. Mosher, district manager.

•

Ender Manufacturing Company, New York City, has appointed Lambert O. Ledford, Rossville, Ga., southeastern district sales manager.

•

Creston E. Kite has been appointed general manager of **Unistrut Eastern Service Co.,** which has opened offices and warehouse facilities at 74 Woolsey St., Irvington, N. J.

•

The Electric Products Company of Cleveland, Ohio, has appointed the J. J. Costello Company as its representatives in the New England states.

Insulated Conduit-
Bushings
Remember when Insulated Bushings were a luxury because they cost so much. That was before UNION entered the field.
Using knowledge gained during the War, on November 1, 1947 UNION introduced the first molded Insulated Bushings. These molded bushings offered economies hitherto unknown.
UNION'S Bushings have a smooth insulated lip that makes wire pulling easy. They will not damage the softest wire insulation. No sharp metallic edges can eat into the wire causing hard-to-locate "grounds".
There is so little difference in the over-all cost of wiring between UNION'S Insulated Bushings and metalic bushings that you cannot afford to risk future trouble from costly "grounds and shorts". It is wise to specify UNION Insulated Bushings throughout as so many are now doing. UNION makes the best.
In sizes 1¼" and up where strength counts, be sure you "see the canvas". Then you know that no substitution of a weaker material can be made.
UNION INSULATING CO.
PARKERSBURG, WEST VIRGINIA

MAGNO-TRONIC
SP 30-40
DUAL SILVER POINT
RELAY
Industrial Electronics
Reflects the Craftsman's Skill
THE MAGNO-TRONIC
FLUORESCENT STARTER
PROTECTS
Fully, automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment.
SIMPLIFIES
Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary. No button to push.
REDUCES COSTS
Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material, thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit.
VERSATILE
Will operate efficiently over an extended voltage range under widely varying temperatures.
GUARANTEED FOR ONE YEAR.
The (SP-15-20) for use with either 15 or 20 watt lamps
The (SP-30-40) for use with either 30 or 40 watt lamps
The (SP-100) for use with 100 watt lamps
Ask for descriptive literature
INDUSTRIAL ELECTRONICS CORP.
MAIN PLANT
Newark 2, N. J.

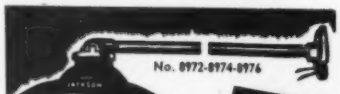
LAY THAT LADDER DOWN!

KETT
TALL REACH
WOOD BORER

DRILLS HOLES HIGH . . . LOW or in the HARD CORNERS

This sensational new tool pays for itself (users report) on the first two or three construction jobs. Drills holes through joists, concrete or steel. 11/16", 12/16" or 16/16" and expansion bits with range from ⅞" to 2¾" are available. Exclusive all-angle head permits drilling extremely close quarters in any direction. Use for wiring, plumbing or heating installations. No ladders, no more reaching, stretching and straining. Can be furnished with or without adjustable extension. Write for Bulletin No. F-3.

THE KETT TOOL COMPANY
5 E. Third St., Cincinnati 2, Ohio



Contractors Want
QUALITY—
They get this and much more with these

JACKSON Quality PRODUCTS

PORCELAIN ENAMELED
YARDLIGHTS

Good Appearance — Service — Business with Profit . . . JACKSON assures all these. Modern design — completely wired and assembled — of one piece heavy gauge steel, finished with three coats of VITREOUS PORCELAIN ENAMEL. Withstands wind and weather. Listed by U. L. — approved for R. E. A. installations. Send for facts.

- Sold only through WHOLESALERS
- Manufacturers of Lighting Equipment

JACKSON
ELECTRICAL COMPANY
900-910 W. Van Buren St., Chicago 7, Ill.

A-W COOPERATION

[FROM PAGE 67]

tractors of the country ignoring the residential wiring field. They are good citizens but they cannot afford profligate philanthropy and then should not be expected to unless some "welfare state" deems it proper to give them a handsome subsidy. This is the reason that the Adequate Wiring program frequently gets in dead center.

The interdependence of the utility, the manufacturer, the wholesaler, and the contractor, when each functions fully and properly should be a basic fundamental of the industry as a whole. Of all these the contractor alone is the one who can shoulder the responsibility to our customers. By virtue of control over procurement, over labor, over installation engineering, the Electrical Contractor alone in the Electrical Industry can guarantee to his customer the proper and satisfactory functioning of an electrical installation. This consideration has never been fully realized by the other branches of the industry and it never has been more than half-heartedly used by the contractor as a business promotion deal. A guaranteed installation is much easier sold and it makes for lasting customer satisfaction.

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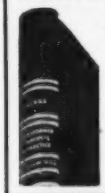

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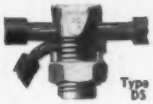

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[FROM PAGE 70]

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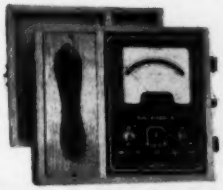

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The author wishes to acknowledge the assistance of the following parties, in the preparation of this article: Mr. John Irwin, General Motors Corp. Plant Engineer; Messrs. F. Boomhauer, V. C. Wagner and C. K. Mackenzie, engineers with Albert Kahn Associates; Mr. J. W. Hooley, Vice president, and Messrs. H. R. Priestly and A. R. Manville, engineers with the J. Livingston Company.

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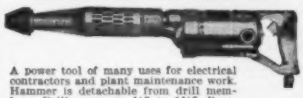

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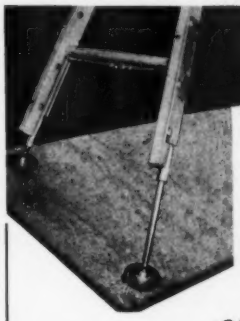

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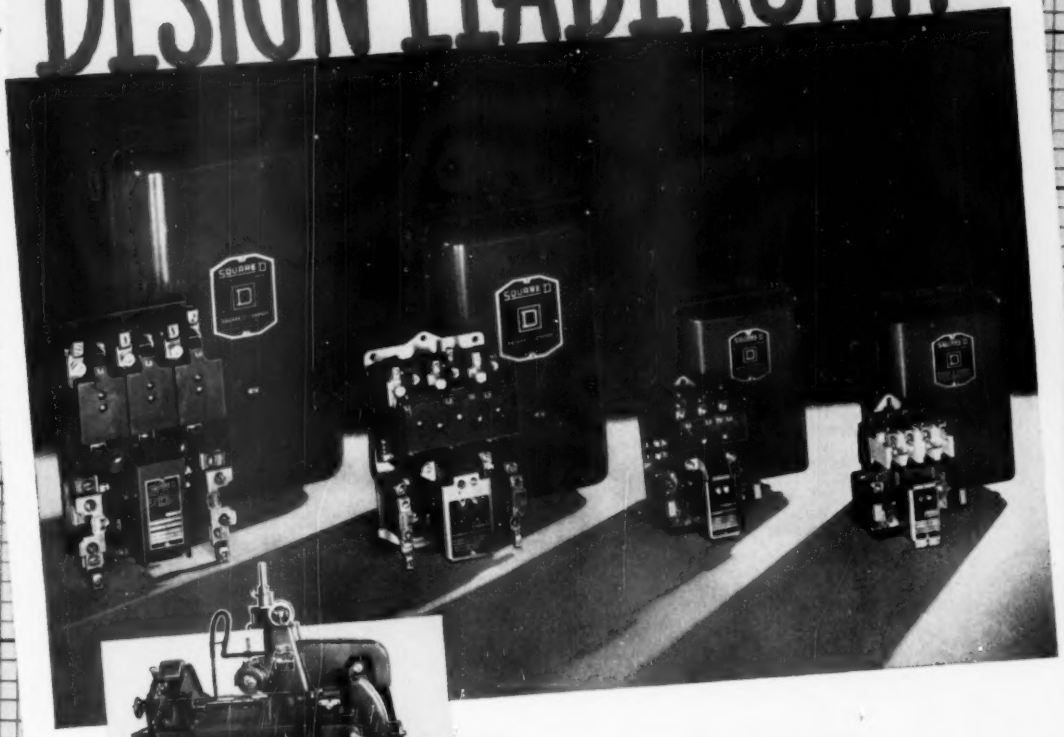

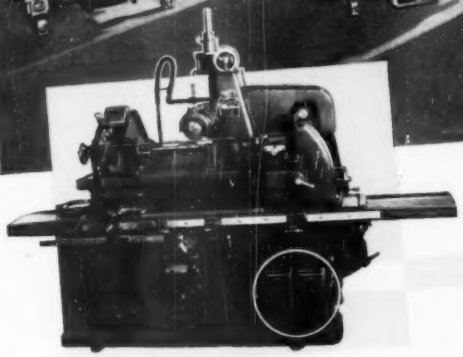

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FOR UP-TO-THE-MINUTE INFORMATION ON G-E WIRES AND CABLES...G-E CONDUIT PRODUCTS...G-E WIRING DEVICES, SEE YOUR GENERAL ELECTRIC CONSTRUCTION MATERIALS DISTRIBUTOR. OR WRITE TO SECTION L2-318 CONSTRUCTION MATERIALS DEPT., GENERAL ELECTRIC CO., BRIDGEPORT 2, CONN.
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